

A Rangelands Dialogue Towards a sustainable future

EDITOR
Paul Sattler



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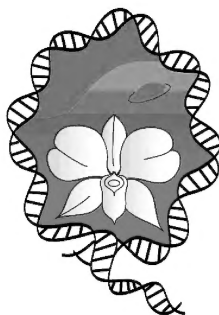
A Rangelands Dialogue
Towards a sustainable future

Editor: Paul Sattler OAM

Contributing Editors: Ross Hynes and Geoff Edwards

The Royal Society of Queensland

*Queensland's first scientific society
Established 1884*



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FRONT COVER ILLUSTRATION

Combo waterhole on the Mitchell Grass Downs, part of the inspiration for Banjo Paterson's *Waltzing Matilda*; a song that captured the spirit of Australia (Photos: P. Sattler).

BACK COVER ILLUSTRATION

Photo: Fiona Leverington

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RANGELAND DECLINE



1. Galloping to a lick (of molasses and urea), but are we galloping to a dust bowl? (Photo: C. Nason).
2. Prickly Acacia (*Acacia nilotica*), a Weed of National Significance, now invades more than 6.6 million hectares of Queensland (Photo: G. Edwards).
3. The introduction of *Bos indicus* breeds, whilst increasing production, has further increased pressure on native pastures (Photo: DAF).
4. Distressed landscape in the Mulga Lands; beyond private capacity to repair (Photo: P. Sattler).
5. Deteriorating stock route infrastructure (Photo: G. Edwards).

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- 1984 *Focus on Stradbroke: New Information on North Stradbroke Island and Surrounding Areas, 1974–1984*
- 1986 *The Mulga Lands*
- 1989 *Rural Queensland: A Sustainable Future: The Application of Geographic Information Systems to Land Planning and Management*
- 1995 *Queensland: the State of Science*
- 2002 *Landscape Health of Queensland*
- 2006 *Bushfire 2006 Conference* (Vol. 115)
- 2011 *A Place of Sandhills: Ecology, Hydrogeomorphology and Management of Queensland's Dune Islands* (Vol. 117)
- 2020 *The Land of Clouds Revisited: The Biodiversity and Ecology of the Eungella Rainforests* (Vol. 125)

FOREWORD

The rangelands, covering about 80% of Australia, are renowned for their highly variable climate and low and erratic rainfall: they are indeed “A land of droughts and flooding rains” (*My Country* by Dorothea Mackellar). Unfortunately, these lands are progressively degrading from the cumulative effects of recurrent droughts and chronic and/or widespread under-management, amongst a range of other factors. In many locations, traditional pastoral enterprises are uneconomic, particularly at the scale of the family farm, which undermines towns and communities as less money is spent in local businesses, jobs are lost and people leave looking for work in larger centres.

The rangelands are being placed under increasing pressure by a changing climate. Acceptance of climate change by some landholders who are already dealing with a highly variable climate is recognised. This influences the level of preparedness that is undertaken or indeed possible for pastoral production to be ecologically sustainable.

The need for new economic settings for viable production, possibly new tenure for repair and protection of multiple values, and government support for the management of ecosystem services, will require a new public/private partnership.

Increasingly, a social compact will be required between urban and rural communities to match their expectations of how the land and its resources are valued and managed. Already investment in pastoral lands for carbon sequestration is occurring. Clarification of the duty-of-care responsibilities between government and landholders in managing land and water will be important, particularly to protect ecosystem services and special values.

This collection of papers is not only about pastoral production. There is a continuing degradation of biodiversity and a lack of representative national parks across many rangeland bioregions. There is a significant and growing nature-based tourism industry, and the Grey Nomad phenomenon provides a baseline of economic support for many towns. The tourism industry may become increasingly constrained by lack of access to natural places, and the industry could be invigorated by consolidation of the park estate.

This Dialogue has raised many questions that require extensive, ongoing research and analysis, for example:

- *Are community expectations unrealistic regarding a sustainable future for the rangelands when in terms of the spectrum of values and purposes identified, most properties are under-resourced, under-staffed and under-managed?*
- *How is it possible to adequately resource, staff and manage these properties to achieve a sustainable future for the rangelands?*
- *Do rangeland industries need a social licence to operate and thrive?*
- *Are the problems of rangelands economically intractable for individuals?*
- *What should be the agricultural policy direction in a modern advanced economy?*
- *How can we encourage groups of people to make their homes in the empty places outback?*

Many of these questions appear intractable at this point in time. This Dialogue and these *Proceedings* have strengthened the conversation amongst some of the key stakeholders and provide a focus for multidisciplinary enquiry to inform policy makers and the broader community.

The key message is that the productivity, viability and resource condition of large parts of our unique rangelands will rapidly decline unless existing policies, economic drivers and management practices are urgently reviewed.

Paul Sattler OAM, Ross Hynes and Geoff Edwards



No. 1 bore at Murweh Station, Warrego District, depth 1800 feet, estimated flow 3,000,000 gallons per day when tapped in 1897. For the next 100 years groundwater flowing freely from numerous bores supported pastoral development across vast rangeland areas of the Great Artesian Basin. Significant loss of pressure led to a joint government and landholder scheme (the Great Artesian Basin Sustainability Initiative – GABSI) to cap the bore heads and to progressively replace the wasteful open bore drains with polypiping in the 1990s and 2000s. Some of the most rare and threatened elements of biodiversity in the rangelands exist in the small artesian-fed springs around the Basin, as documented in ‘Springs of the Great Artesian Basin’, *Proceedings of The Royal Society of Queensland*, Volume 126, accessible at <http://www.royalsocietyqld.org/springs-special-issue-vol-126/> (Photo: Queensland State Archives).

EXECUTIVE SUMMARY

The discussion at the Rangelands Dialogue and within the pages of these *Proceedings* produced much information that is directly relevant to contemporary policy and management challenges. Accordingly, the Executive Summary of these *Proceedings* presents a list of the key points extracted from the 26 papers that follow. These summary dot points highlight key issues and can assist in taking responses regarding distress in the rangelands forward to the three levels of government and to inform the wider community.

Whilst it is not suggested that this Dialogue covered all aspects of rangelands management, its values and resources, the information presented indicates that action is urgently required if a sustainable future is to be realised. Biodiversity, water resources, Indigenous interests and the viability of businesses, both rural and urban, are obvious subjects requiring further investigation. Regional assessment of these issues across the varied subregions of the rangelands would also be important in charting the way forward.

Setting the Scene

David George

Keywords: climate risk, climate change adaptation, risk management, needs, vulnerability, planning, education

- The needs of pastoralists vary as a consequence of the cumulative factors and elements that provide a picture of vulnerability.
- Any climate-change scenario that exacerbates climate variability makes future sustainability of natural resources and communities even more difficult.
- Feedback indicates that the whole system is in crisis and potentially in a state of collapse.
- There needs to be critical analysis of the future scenarios of resource condition and trend, in order to achieve sustainable communities. This analysis must be driven by science and unfettered by politics.
- Two key questions emerge:
 - Is climate change a mere inconvenience in the rangelands?
 - How can carbon farming be framed so as to offer only positive economic benefits and not risk exposure to potential payments?
- Developing thorough climate risk management strategies at farm level and at industry level must have an expanded role.

Des Hoban

Keywords: underlying drivers, transformative change, governance deficit

- Rangelands are really stressed, including the land, people, communities and biodiversity.
- Impacts of climate change will escalate.
- Strategic research in the rangelands has been lost, and management will become trickier with climate change.
- There is a need for adequate resourcing and new institutional arrangements for transformative change.
- Past dogmas on topics such as the virtues of family farming or the merits of the free market should be carefully scrutinised.

Paul Sattler

Keywords: rangelands, conservation, national parks, duty of care

- In 1884, The Royal Society of Queensland's first President, A. C. Gregory, argued in Parliament against wide-scale clearing of the *Acacia* (brigalow) forests due to the likely impacts on rainfall.
- Nearly 100 years later in 1982, the RSQ held a Symposium on the Brigalow Belt due to concern over the extent of clearing. It was reported that only 0.5% of the original extent of brigalow was conserved, with many ecosystem types not protected.
- In 2003, modelling by CSIRO showed that a 10-fold increase in salinity could occur in parts of the Murray-Darling Basin in Queensland due to the extent of clearing, and that only a narrow window existed for action to keep the salt down in the soil profile.
- In 1985, the RSQ held a Symposium on the Mulga Lands owing to the widespread degradation due to grazing and that no national parks existed across this large bioregion. Many of the conclusions of that Symposium have been raised again at this Dialogue with little to no progress.
- In the 1990s, a number of national parks were acquired across the rangelands based on building a representative parks system. Significant effort to consolidate the park system as part of a range of conservation measures and as part of achieving sustainable managed rangelands is required to protect biodiversity, especially with the increasing impacts of climate change.
- Defining and implementing a private and a public duty of care will be a key component in planning sustainable management, in assessing public-good responsibilities and in building support across multiple stakeholders.

Economics

Ben Rees

Keywords: monetarism, monetary, Engel's Law, Say's Law

- From the early 1990s, agriculture policy has been based on rural adjustment to increase economies of scale and competitiveness, along with farmer self-reliance.
- In 1989, \$1.00 debt produced \$2.14 in output. In 2010, \$1.00 debt produced \$0.64 in output.
- Rural adjustment and reducing the number of farmers have not produced the theoretical economies of scale.
- Other sectors of the economy would have demanded change in policy direction.
- Employment has declined from 1992 onwards, especially amongst the self-employed and owner/managers, contrary to strong rising employment in other sections of the economy.

Mark McGovern

Keywords: returns to factors of production, systemic failures, capital renewal, regional Australia

- We are living in times of comprehensive capital run-down with inadequate returns to all manner of capitals, from natural and societal to economic and financial.
- Currently preferred economic and system models are inadequate, leading to serious foundational flaws in commercial, financial and public policies.
- Economic and financial distress is deepening, with significant dislocation and loss of key capacities in rural areas, including much of the rangelands.
- Drought and other natural disasters have highlighted deep problems, including unserviceable debts and inadequate farm production models, that need due attention.

- “How are borrowers and lenders in the agricultural sector to deal with the consequences of uncontrollable and unforeseen external events?” (as posed by Commissioner Hayne) remains unacknowledged and unanswered.
- In 2011, the Credit Committee of the Rural Bank noted that it had been “highlighted [5 years earlier] that the value of Queensland cattle properties were heading into a pure asset bubble and these warnings appear to have been ignored”; so, by definition, loans were being made without due regard to likely servicing incomes from after 2006.
- Program funds such as Commonwealth farm loans to temporarily ameliorate severe balance sheet strain could be better applied to rural capital stabilisation and restoration of natural assets via reconstruction and stewardship projects.

Jon Stanford

Keywords: pastoralism changes, beef consumption, climate change and international organisations, climate change and financial institutions, social cost of carbon, green bonds

- Consideration of climate change cannot be local; climate change itself is global, and a successful challenge to climate change must be global.
- Government intervention is required; Stern (2007) characterised climate change as the greatest market failure of all time.
- The convergence of approach to climate change by international financial organisations and national regulators is significant as it indicates possible future developments.
- The major developments are that insurers will scrutinise their exposure to areas affected by severe weather events; in extreme cases some rangeland assets may be denied insurance and bank finance.
- Existing lenders may look more favourably on activities promoting climate change, and innovations in the capital market may lead to greater funding for projects assisting in the transition to a carbon-neutral economy.
- The economic costs of the North Queensland floods in 2019 shed some light on the possibilities of the future. Warming is also expected to affect livestock through physiological changes, heat stress and availability of water.

Social Landscape

Heather Douglas

Keywords: rural development, repopulation, wellbeing, policy

- Rangelands cover about 80% of the Australian landmass.
- Population is unevenly distributed across Australia: average population density is 3.1 people/km², but 71% of the population lives in large coastal cities. Indigenous Australians comprise 3% of the population.
- The Australian population increased by 4 million between 2006 and 2016, but the rural population declined by more than 5%.
- Life has become more difficult in the rangelands. Overall wellbeing is lower than urban populations: rangeland residents are older, less skilled, poorer and less healthy than those in urban areas.
- Rangelands are no longer embedded in the hearts and minds of the nation, so there is a need to rethink the future.

- Changes must increase the population, create social and economic value, improve wellbeing and have effective governance.
- Indigenous development approaches are relevant to the future of the rangelands.
- Four industries have great potential to operate alongside grazing to repopulate the rangelands and improve wellbeing, viz.:
 - alternative energy;
 - major tourism events and an Indigenous Cultural Museum;
 - an inland space centre; and
 - an Outback University.

Climate Change

David Lloyd, David George and Jeff Clewett

Keywords: climate change, risk management, best management practice, education, extension, adaptation

- Climate change is a new and evolving challenge that is placing increasing downward pressure on the productivity of landscapes, long-term livestock carrying capacities and the social and economic fabric of the rangelands.
- Warming trends are not part of a short-term cycle and are linked to changes in rainfall, health of ecosystems and agriculture productivity, including in the rangelands of Australia.
- Adaption to and mitigation against climate change is essential, not optional. Business as usual, ‘no action’ or maladaptation is contrary to the best interests of Australian agriculture and natural resources.
- New climate change and risk-management skills will be required for managing natural resources.
- Increased emphasis on education and extension processes must therefore be a higher priority in order to improve the adaptive capacity of individuals and organisations if we are to better manage climate change and drought.

Planning and Policy

Michael Jeffery

Keywords: soils for life, water and food security

- Many areas of the world face substantial soil, water and food sustainability issues. The President of the World Bank has drawn attention to the fact that: “Fights over water and food are going to be the most significant direct impacts of climate change in the next 5 to 10 years.”
- There is a need for all Australian governments to establish a national objective to restore and maintain the health of the Australian agricultural landscape.
- This must be supported by proven, sustainable farming techniques.

Michael Guerin

Keywords: consultation, environmental regulation, stakeholder respect

- The value and significance of the rangelands are not broadly understood.
- There is a need for better engagement with industry when policy settings are changed by governments.
- Property purchase for carbon credits can mean reduced economic activity and families leaving, which further reduce the resilience of local communities.

- AgForce believes vegetation management legislation is unfair, has wrong policy settings and is difficult to understand and difficult to explain to graziers. This is made worse by numerous changes over the past 20 years.
- Industry wants to contribute more, economically, socially and environmentally.
- AgForce and industry support pilot projects in several bioregions to demonstrate sustainable management of regional ecosystems and to reward best practice.

Geoff Edwards

Keywords: land-use planning, statutory authority

- Land-use planning in Queensland rangelands is required to examine the future use of leasehold lands, long before lease expiry, as well as to determine land-use requirements associated with the freeholding of leasehold lands. Leasehold land makes up >60% of the state.
- Such planning would appraise the value of land for other purposes such as national parks utilising established scientific assessment criteria.
- Pre-eminently, it would examine the implications of climate change and environment degradation to determine sustainable management regimes going forward.
- In parts of Queensland the model of the family pastoral farm may no longer be appropriate given the converging challenges of climate change, the prevailing economic framework, the cost of restoration of degraded lands, the inability to manage degraded lands sustainably, the inflated value of properties and the hollowing out of local communities.
- The Land Conservation Council of Victoria provides a useful model for land-use decision making on a systematic and consultative basis.
- There has been significant loss of research and monitoring capacity for assessing the condition and trend of natural resources and in providing sustainable models of land use.

Martin Taylor

Keywords: national parks, protected areas, ecosystem services, biodiversity, wildlife, tourism, Queensland, rangelands

- National parks (and to an increasing extent, non-government protected areas) make a vital contribution to the future economic growth of the rangelands.
- Terrestrial national parks and other protected areas conserve non-tourism ecosystem services worth at least \$37 billion per year.
- Wild-nature tourists spent \$23.6 billion in 2012–2013.
- Grey nomad tourism is growing significantly, with tourists spending up to \$16,000 each per annum in 2011 throughout Australia.
- Only 25% of regional ecosystems in Queensland are adequately protected, together with less than half of nationally listed threatened species.
- Investment in carefully planned facilities for the rapidly growing grey nomad tourism sector, in conjunction with securing new rangeland parks to achieve a fully representative system, will help diversify regional economies.

Don Keith

Keywords: native forest, apiculture, crop pollination

- The beekeeping industry has been significantly impacted by vegetation clearing, the impact of warming temperatures on vegetation, pest and disease incursions in recent decades, and the use of insecticides in broadacre farming.

- Industry decline has reduced the availability of honeybees for pollination. Maintenance of a viable beekeeping industry is vital for growth in the agriculture sector through the provision of adequate pollination services.
- Modest climate warming has caused trees to flower earlier, significantly reducing honey production, and droughts have reduced nectar production.
- With warming, peak nectar flows may be increasing out of synchronisation with insect emergence, thus contributing to widespread insect and ecosystem decline.
- Allowing the Traprock forests west of Warwick, one of Australia's premier honey production areas, to revegetate as carbon stores may be an important way forward that also provides precious floral resources for the beekeeping industry.

Ross Hynes

Keywords: crucial concepts, rangeland policy, relevant research strategies

- With climate change, impacts are accelerating and rangeland management strategies will need to rapidly adjust to enable optimum use to be made of shorter windows of production in a more unpredictable and fluctuating environment.
- Some enterprises will need to become mobilised to take advantage of intermittent rainfall events across regions, whilst some areas will need to be retired to protect remaining values and for restoration.
- Ideally, producers and conservationists should agree on thresholds of resource use to protect multiple values.
- To achieve the above effectively, all research and emerging policy need to be framed within a whole-systems approach. Why? Because the changes needed are encompassed within whole systems – systems that variously accommodate resource-use patterns that affect environmental, social, cultural and economic components across a range of scales and crucially affect their long-term persistence.

Peter Dart

Keywords: unconventional gas, mining, aquifer hydrology, land restoration, weeds, human health

- Mining for minerals (especially coal) and unconventional gas can devastate large areas of good-quality agricultural land and deplete or contaminate water resources.
- Fugitive emissions of greenhouse gases such as CH₄ from mining are not adequately measured on a continuing basis, and usually baseline measures are not taken before mining starts.
- Fracking for unconventional gas (shale and coal-seam gas) places a huge burden on water resources. Use of extracted water is very controversial, especially disposal of the salt produced.
- Fugitive emissions also contain volatile organic compounds (VOC) which can affect human and animal health.
- A major legacy problem exists in relation to the poor record of rehabilitation.
- Financial guarantees, risk assessment and community engagement are needed to ensure that mining occurs with the least impact and that rehabilitation is adequate.
- The legislation around mining does not address industry insurance to ensure that landholders are adequately covered for the impacts of mining.

Clem Campbell

Keywords: sustainable wildlife ownership, integrated wildlife management

- The Earth Charter advocates an ethical framework for sustainable rangeland management.

- A rangeland policy framework must focus on the unique landscape and ecosystems through a regional approach that engages all stakeholders.

Dana Kelly

Keywords: rangelands, pastoralists, United Nations Declaration

- Rangelands cover over half of the earth's land surface but tend to be a low priority for governments.
- Rangeland pastoralists around the world are among the world's most marginalised people.
- The Government of Mongolia is calling for an International Year of Rangelands and Pastoralists (IYRP) to increase global recognition of the value of rangelands and pastoralists, and of the increasing land-use pressures, climate change, population pressures and habitat stress.
- Australia's participation in an IYRP could further enhance our high reputation in pastoralism and would have many benefits and opportunities, including clean and green products, rural business skills, tourism, the export of solar power, and carbon management programs.
- Organisations are encouraged to support the Government of Mongolia. The UN will make a decision on the IYRP in 2020.

James Hansen

Keywords: scenario, Townsville, flood, planning

- Macro-management of extreme natural events is essential. This includes pre-planning and management to avoid uncoordinated and chaotic responses.

Pastoral Management

Geoff Niethe and Phil Holmes

Keywords: drought strategies, sustainability, stock losses, national carrying capacity, stubble grazing

- Given the decline in stock numbers in Australia, could we run sustainable historical numbers again?
- Since the 1960s, the factors leading to loss of carrying capacity in the rangelands is multi-faceted and includes:
 - the capital value of land in comparison with the value of stock;
 - increased utilisation of country, leading to lack of reserves for dry years;
 - retention of stock on pastures beyond their capacity to regenerate; and
 - over-utilisation of ground and surface waters.
- A change of focus in management is needed. The relationship between profit and pasture availability can be demonstrated in the most arid of situations.
- Management of grazing pressure is fundamental to land condition; for example, carrying capacity in the Gulf region is shown to have declined with deteriorating land condition and, if this trend continues, 50% of original carrying capacity could be lost by 2046.
- The focus must be to turn from management of stock to management of pastures and land condition.
- Assistance packages should embrace measures that demonstrate prior planning and 'best practice' grazing management.

Michael Yeates

Keywords: land management, long-term ecology, physical geography, family history, case studies

- Historical records of individual properties and related family histories can provide reliable local indicators of previous management challenges and related climatic conditions.

- Major floods have been a feature of those records, so references to average rainfall measures are useless unless very localised and very detailed.
- The variable and unpredictable nature of drought remains the most significant issue facing grazing in Australia.
- The threat to grazing lands lies in the optimism, the opportunism and the lack of understanding that drove early pioneers and continues to this day.
- If drought is such a threat, areas should be considered for alternative, sustainable uses, including tourism and conservation, with areas permanently destocked to allow restoration.

Alan Lauder

Keywords: Carbon Grazing, carbon trading, carbon stocks and flows

- Understanding carbon flows is crucial for sustainable pastoral management: carbon flows in short (labile), medium- and long-term cycles.
- Stewardship incentives can be justified for management changes that increase the flow of carbon, which improves paddock and catchment condition.
- Payments for carbon credits deal in long-term stocks of carbon and say little about driving the health of the landscape. Different metrics are required to assess short and medium flow versus long-term stocks.

David Marlow

Keywords: small water cycles

- In mismanaged landscapes with little ground cover and carbon-deficient and compacted soils, 'small water cycles' are degraded. Cropping and grazing practices need to be redefined to repair small water cycles.
- A healthy, carbon-rich soil generates local rainfall, reduces fire intensity and helps to create essential cloud cover.
- In large water cycles, rains are more irregular and often occur as major events.
- Queensland needs a state-wide water and evaporation management plan.

Howard Briggs

Keywords: degradation of pastoral lands, total grazing pressure, normality of drought, national approach to pastoral land management

- Queensland pastoral lands are degrading.
- Grazing pressures from livestock and wildlife need to be lowered.
- Drought is part of the normal operating environment.
- A national approach to managing pastoral lands is warranted.
- The way forward needs to recognise the private and public interests of those affected.
- The changes required will have significant social, economic and environmental consequences.

Margaret House

Keywords: tree clearing, Desert Uplands

- Older landholders, over 70, are in a better financial position with less debt and are more interested and active in the environmental health of their properties.
- Younger landholders are very interested, but their financial situation can prevent them from taking

much action. Most people who contact the Desert Uplands Committee regarding the availability of grants or assistance for environmental works are usually the younger folk.

- All Australians should contribute to the cost of landholders caring for the land.
- Landholders should be rewarded for caring for special ecological values.
- More carbon and environmental research needs to be done over a timeframe of 15-plus years, in country where trees have been pulled down and in the old-growth forest next to it.

Management – Landcare

Ken Keith

Keywords: ecosystem services, landcare, fencing clusters

- Early Landcare had great momentum and participation, but local groups with limited resources were unlikely to produce landscape-level change.
- Subsequent regional structures and purchaser–provider models missed the opportunity of more effective delivery through the network of community groups.
- Social capital built into cluster groups could be a force for delivery of ecosystem services.
- Landcare and cluster groups linked to larger administrative aggregations could be a focus for technical advice on management of ecosystem services and for auditing.
- A two-tiered system with Landcare groups linked to district Landcare committees, catchment management or natural resource management bodies would reinvigorate Landcare.

Paul McDonald

Keywords: rural extension, rural policy, land managers

- The majority of attempts at rural extension do not reach landholders or their learning networks.
- People who impact the rangelands should be at the centre of their own learning to help them measure improvements in ways that make sense to them.

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The papers in these *Proceedings* originated as briefing papers for the Rangelands Dialogue convened by The Royal Society of Queensland, AgForce and Natural Resource Management Regions Queensland in July 2019. They take the form of either short communications or opinion pieces. The editing has been conducted in a way to maintain the views of a cross-section of stakeholders from pastoralists to scientists and therefore is categorised as lightly peer-reviewed.

Introduction

David A. George

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dg881885@gmail.com

Keywords: climate risk, climate change adaptation, risk management, needs, vulnerability, planning, education

Pastoralists from Queensland rangelands along with scientists and concerned citizens held a two-day dialogue in Brisbane in July 2019. This dialogue was initiated by The Royal Society of Queensland in response primarily to the worsening drought, concerns about pastoralists' well-being, and the considered potentially irreversible degradation of the rangelands. It was co-hosted by The Royal Society of Queensland, NRM Regions Queensland and AgForce Queensland.

The objective was to provide a forum for a constructive discussion with key stakeholders. Issues concerning the prolonged drought, together with actions that may alleviate the grim situation and serious future climatic outlook given a climate-changing world and an evolving carbon economy, were raised. Figure 1 highlights the current drought severity, duration and extent, combined with increased temperatures. Positive aspects, including ideas, innovations and success stories from other sectors were also presented and could shine a beacon for current leaders to consider and potentially emulate.

About 120 attendees had the opportunity to converse, listen, clarify and discuss issues on a range of topics which included updates on natural resources, climate, economics, industry analysis, tourism, conservation of biodiversity, and perspectives from mayors and others on changing demographics and community needs. Policy issues dealing with NRM planning, stewardship and duty-of-care responsibilities for sustainable

management were raised, together with the economic constraints that exist. These issues have been collated into these *Proceedings*.

Why this time? Why this group? These are relevant questions which can assist the reader to place this meeting in a proper context. As of July 2019, the current drought had already been endured for more than four years (Figure 1A). It was not forecast as breaking soon and was testing communities, towns, and the most senior pastoralists who had been through severe hardships before. However, nothing like the current situation had been experienced previously in their lifetimes, and it was stated that:

- feed was almost non-existent;
- finances were diminishing; and
- hope for a positive future was waning.

A future reality was described as one where considerations of rebuilding herds and flocks, even under ideal pristine pasture and water conditions, were beyond the scope of many because of the average age of most pastoralists and the lag time to bring back reasonable returns. The prominent consideration resounding from pastoralists was: "Is it worth it?" Pastoralists consider there now exists a trend of diminishing returns that did not look likely to reverse any time soon. Furthermore, hopes of the current generation for a younger replacement generation were seen as fading because the trend was seen as becoming an untenable burden, and any notion of an estate

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and retirement plan for children that incorporated pastoralism was considered as being abandoned.

Early focus of the dialogue was on identifying:

- What lessons can be learned from this drought now to redeem the situation and help avoid potential future despair when confronted with forthcoming droughts?
- How could targeted support be urgently provided as a safety net for a beleaguered but critically important sector of our community?

The discussion centred on the immediate emphasis of addressing the ‘here and now’, which was more urgent and important than any future situation. However, the need to consider underlying problems also surfaced.

The needs of pastoralists vary as a consequence of the cumulative factors and elements that provide a picture of vulnerability (Table 1). After some reflection and analysis, it became apparent that the elements of sustainability are leaning towards a more permanent state of greater vulnerability. These issues are a synthesis of factors and not easy to untangle and point to a simple remedy. However, given such a background, the only conclusion that can be drawn to date is that our rangeland managers and communities are extremely vulnerable to the impacts of the current drought. Any climate change scenario that exacerbates climate variability makes future sustainability of natural resources and communities even more difficult. It became obvious from

feedback that the whole system is in crisis and seen to be, potentially, in a state of collapse.

Furthermore, there is simply no easy fix and there is no quick fix. There needs to be critical analysis of the future scenarios of resource condition and trend, in order to achieve sustainable communities. This analysis must be driven by science and unfettered by politics.

Presuming we have *managed and planned for climate variability* as best we can so far means *we know what is coming and have prepared meticulously to counter it*. The majority of pastoralists are saying clearly in this instance that their preparations were shown to be, at best, inadequate. Since these preparations have not been sufficient, it follows that planning is either poor or we are in ‘new territory’ that has not been experienced to date and is beyond the scope of our current policy and management capabilities and capacity. Whichever of the above options is considered reasonable, at the very least, developing thorough climate risk management strategies at farm level and at industry level must *ipso facto* have an expanded role. Therefore, the key questions which underpinned discussions and need answering are:

- 1. Is climate change a mere inconvenience to Queensland’s rangelands?***
- 2. How can carbon farming in Queensland rangelands be framed so as to offer only positive economic benefits and not risk exposure to potential payments?***

* These are not intended to be just rhetorical questions. I have argued my position and provided my answer in part to both these issues in previous companion papers/conferences, which are:

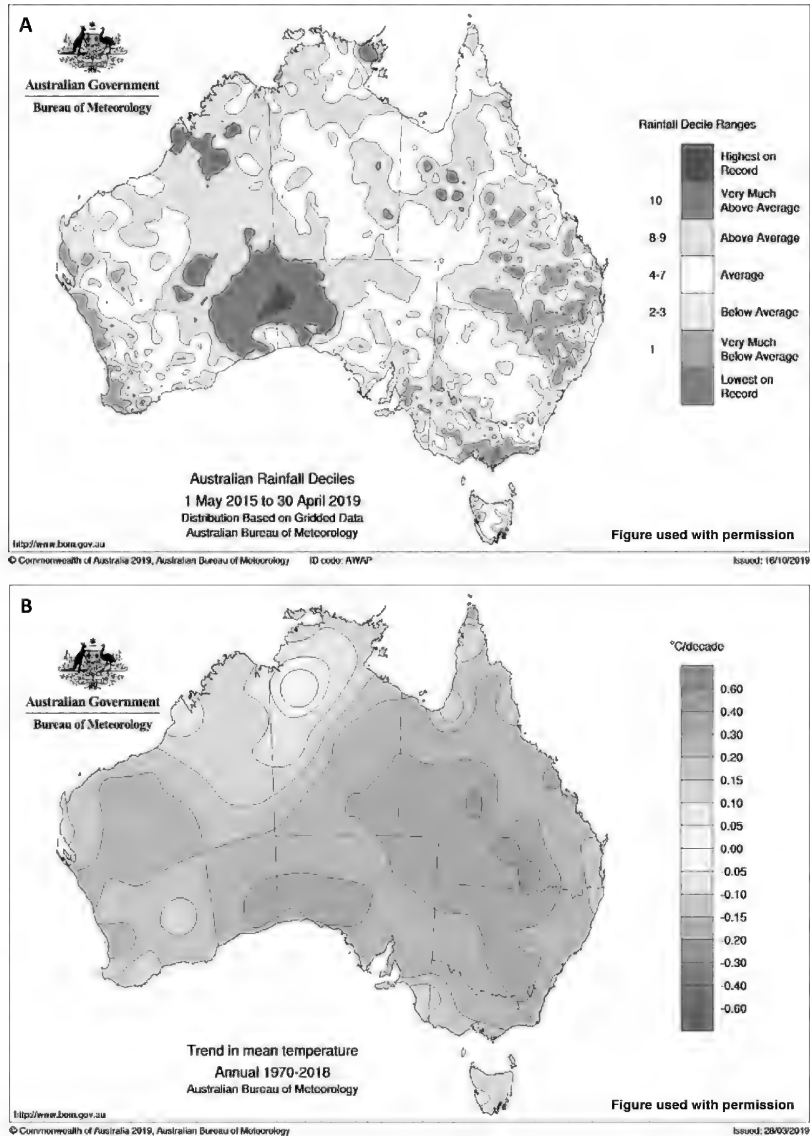
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Figure 1. A) Recent rainfall deciles. B) Mean temperature trends in Australia. (Used with permission)



Framing the above two questions for discussion along the lines of climate risk management is paramount because it encompasses: (i) attitudes to risk; (ii) the current situation; and (iii) 'individual' and 'corporate' knowledge and skill levels. Furthermore, if options to adapt/

mitigate go beyond justifying satisfactory cost-benefit returns, they raise the question: at what point does an industry concede 'retreat' is the best option? How this can be structured to ensure dignity and respect for people, and a relatively intact resource base which is able to recalibrate,

is a challenge. Risk management enables this. Leaving it to current conventional market forces alone does not. Climate change, if false, is of no importance, and if true, is of critical importance. The only thing it cannot be is moderately important. It therefore commands a considered response. The Future Drought Fund and proposed Plan announced in October 2019 by the Federal Government has a focus on improving resilience of communities, production and the resource base. Therefore, it must address the above legitimate but uncomfortable key issues that were raised in this dialogue because: (i) they require a dignified answer instead of being rebuffed or just ignored; (ii) the longer they remain unanswered, the longer the historical cycle of drought dysfunction is perpetuated; and (iii)

only when these two questions are answered can there be a chance to break the cycle of ‘circular argument’ that prevails regarding climate variability/cyclical change vs. human-induced climate change at this time, and light a pathway to another future where Queensland rangeland pastoralists are not just servants to the conditions that prevail, but have some positive role and certainty in managing their own destiny. Many graziers already manage their own destiny well, and their industry in general desires assistance to do this more effectively. They therefore desire policies that support their ability to manage for drought and adapt to a changing climate better, which generally means flexibly. They also desire policies that are equitable and supportive, rather than hinder resilience-building.

Table 1. Factors affecting lower and higher vulnerability which determine how primary industries can operate sustainably in the Queensland rangelands pastoral industry (illustrative purposes only).

Factors	Vulnerability Dynamic		
	Lower vulnerability	Moderate vulnerability	Higher vulnerability
Financial	>2% Return on Investment (ROI) + investments		<1% Return on Investment (ROI) + no investments
Social	Social time available and active participation in such activities		No participation in social activities
Human	Solid family support		Little or weak or no family support
Physical	Capital assets maintained, in good working order and fit for purpose		Poorly maintained/ignored capital assets
Natural	‘Good’ condition soils, pasture/vegetation, biodiversity, water (quality and quantity)		‘Degraded/diminished’ soils, pasture/vegetation, water, biodiversity

Note: Not all factors and elements are equal. Of significantly higher value are: good health; educational capacity; financial position; social support; strong resource base. Conversely, factors and elements that contribute to greater vulnerability are: older age and poorer health; higher debt loads; poorer historical ROI; etc. Those in a strong position have lower vulnerability (the green-shaded zone); those in a weak position have higher vulnerability (the red-shaded zone). Historically, pastoralists consider they were able to be comfortably located in the aggregated ‘green zone’; whereas now, they consider their capacity to cope has been inadequate and they are now operating in the ‘red zone’. They are saying loud and clear that it is not a position with which they are comfortable and nor are they necessarily there as a result of their own making.

Author Profile

Dr David Alan George is Adjunct Associate Professor, Australian Rivers Institute, Griffith University (formerly Senior Natural Resources Management Specialist with the Climate Change Practice at The World Bank). He has developed, delivered and evaluated applied climate courses in the primary industries sector and established national accreditation of climate risk management strategies.

Putting Things Right in the Rangelands

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Keywords: underlying drivers, transformative change, governance deficit

The Outback takes in the red centre and the great pastoral regions of the inland. The most vulnerable parts of this vast area are the ‘rangelands’, the great pastoral regions of the inland. What little rain they get is patchy and irregular. That is what makes their management so challenging at the best of times.

Right now the rangelands are really stressed. People are stressed, communities are hollowing out, native mammals are more threatened than ever, and graziers are carrying way too much debt. And now climate change is going to make droughts longer, hotter and even more erratic.

Old Remedies for Familiar Sores

The striking aspect in all of this is how we continue to rely on partial remedies to ‘put things right’. However, we as a community are good at practical responses to pressing problems. There are good stories out there. Individuals and groups are busy with all manner of support activities. Fodder rolls are arriving from better-off districts; banks are showing a little compassion; relief payments are more accessible. Agencies are getting better with mental health services; others are looking further ahead. Some are demonstrating regenerative farming practices; some are promoting a more holistic relationship with country. Carbon farming initiatives are under way.

Obvious solutions can have perverse outcomes. Cutting down trees can improve short-term profitability but at the expense of land

condition and biodiversity for future generations. Converting pastoral properties to tree farms can also boost income, but locked gates hollow out communities and undermine pest control programs.

But the killer point is that, when taken together, our many remedies are simply not enough. Poverty, suicides and other stress indicators remain stuck on ‘code red’ for rural Queensland. Clearly, busying ourselves with old remedies for familiar sores won’t do.

Doing Rangelands Policy

Where we struggle is in the business of acting collectively on the big issues. We get busy with remedies before checking to see if the diagnosis is right. The world-weary remind us that these things run in cycles. The wary warn that patterns are changing. We should learn from Indigenous people about ‘living on country’. Scholars want to build the knowledge base. Market ideologues want more competition. Community groups want better services.

We are good at brainstorming the causes and effects of distress in the rangelands. The archives record our many endeavours at unpacking ‘the crisis in the bush’. Everyone knows what the real problems are, and everyone wants to know why we don’t get on with it.

But we don’t have much of an appetite for drilling down to expose the underlying pressures which are driving that distress or to canvass

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novel approaches for dealing with transformative change. The real challenge now is to develop overall strategies for managing the rangelands for good environmental, social, economic and governance outcomes as we move forward into a very challenging future.

Admittedly, policy analysis at this level is contested and challenging, as witness our national response to climate change or our record here in Queensland on vegetation management, still festering after 20 years of disagreement.

There are factors which make policy paralysis on rangeland matters particularly problematic. First, the political agenda is dominated by metropolitan affairs and institutional capacity in the bush has been degraded. So there is a chronic governance deficit. Rangelands policy is characterised by short bursts of federal intervention with long periods of state neglect.

New governments in Canberra roll out programs for the latest rural crisis. But these cashed-up, centrally driven initiatives can struggle to deliver what they promise, as witness the current mess in the Murray-Darling Basin. State governments are the official custodians of country, but they take their rangeland responsibilities lightly. For the past 20 years and more, George Street has been running down its capacity for strategic research and land management in the rangelands. Pastoral and agricultural colleges at Longreach and Charleville are mothballed, and some national parks are managed by absentee rangers.

Second, sectoral bias can distort the analysis of rangeland issues where problems are defined in terms of the environmental, the social or the economic backgrounds from which experts operate. This is understandable. But it is unhelpful.

The sectors cross over. For example, it is evident by now that many family grazing enterprises can't absorb the costs of managing through long periods of drought. Enterprises which are distressed financially can't maintain land condition and biodiversity, so distressed pastoral elders are leaving the industry and taking their hard-won

knowledge with them. That loss diminishes our capacity to manage future disruptive change.

Looking Ahead

We know that managing the rangelands is going to get a lot trickier. Economic growth is ramping up world demand for food while good land is being diverted to other uses. Our rangelands are a resource for closing the forthcoming food gap. Foreign institutions are already banking broad-acres as a hedge against food insecurity.

Climate change is making weather patterns more erratic with longer droughts and hotter days. For example, under one scenario Longreach will, within a decade or so, experience 42 *more* days a year with temperatures above 35°C. Productivity falls off at high temperatures, so we can expect a lot of 'down time' on productive activity in the future.

A Strategy for Managing Disruptive Change in the Rangelands

Leaving communities to go it alone against drought is past its use-by date as a strategy for managing the rangelands. It is failing long-suffering communities now, and it is not fit for the purpose of managing the transformative changes which are now unfolding. We need a better strategy for managing the rangelands, and we need a better process for doing rangelands policy. Here are some observations which may assist.

Understandings which should inform this project include:

- Remote communities have demonstrated great resilience in responding to the troubles in the bush, but they do not have the resources to cope with the transformative changes that are now unfolding. The wider political community must join with them in devising and implementing a new deal for the rangelands.
- The issues are complex and interrelated, so we should not be looking for a master plan or a blueprint. We should develop

the capacity to formulate and implement policy appropriate to the circumstances of particular regions in a period of transformative change.

The rationale for embarking on this project is that remote communities are now in distress and external factors are set to increase stress levels. The lessons learned in better managing the pastoral regions of Queensland will benefit land managers across the Outback and in countries dealing with desertification and related issues.

The principal questions the project should address can be stated in sectoral terms as:

- How can rangelands environments be managed for biodiversity protection and sustainable environmental function?
- What alternative enterprise structures can be devised to allow the conventional family pastoral enterprise to transition to benefit from the lower-risk profiles enjoyed by larger corporates and foreign investors?
- What are the roles and responsibilities of remote communities and the wider political

community in formulating and implementing policy on rangeland matters?

With these observations in mind, the purpose of the project is to devise a system of governance fit for achieving better economic, social and environmental outcomes in the rangelands in these times of transformative change.

The process for pursuing that objective must necessarily be innovative and exploratory. The design and delivery of deliberative forums is a way of seeking innovative new approaches. It must establish legitimacy in remote communities and in the wider political community. Partisan dogmas and doctrines, e.g. on the virtues of the family farm or the free market, should be discouraged.

If the strategy is to be successfully implemented, it must be adequately resourced, including the resourcing of institutional arrangements that seek to improve on those adopted in the past. The strategy must be enabled to generate the inter-agency and inter-governmental coordination necessary and to establish the monitoring, reporting, compliance and review measures to judge its effectiveness and continuing relevance.

Author Profile

Des Hoban is qualified in economics and regional planning and has a doctorate in government. He started out as a Patrol Officer in PNG. These days he convenes a bush care group in Brisbane. In between times, he worked on regional planning projects in Australia and development assistance programs in neighbouring countries.



Summer storms can bring local relief for some (Photo: D. Hoban).

Some Key Initiatives in the Conservation and Management of Queensland's Rangelands

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Keywords: rangelands, conservation, national parks, duty of care



As we review the future of Queensland's rangelands, it is useful to highlight some key initiatives that have shaped their conservation and management, particularly those by The Royal Society of Queensland (RSQ). Indeed, we are indebted to Sir James Ramsay, Governor of Queensland and RSQ Patron, for his historical remarks in opening The Brigalow Belt of Australia Symposium in 1982 (Ramsay, 1984).

One hundred years earlier, in 1884 when the RSQ was formed, the Society's first President, A. C. Gregory (the explorer and Surveyor General), in a debate on the Land Bill of 1884, argued against the opening up of the brigalow country. His arguments held sway and the Legislative Council reported: "It is doubtful whether an extensive destruction of the Acacia forest may not decrease the already deficient rainfall in the interior ..." It was not for another 15 years that the selection of brigalow scrub areas was allowed (a thankless opportunity: to develop brigalow blocks with an axe).

The brigalow symposium was organised by the RSQ (Bailey, 1984) partially in response to the extensive clearing of brigalow (*Acacia harpophylla*). It was calculated that only a half of one per cent of the original six million hectares of

brigalow was reserved, with many types not protected (Sattler & Webster, 1984). The requirement by the Lands Department for properties to leave 10% uncleared also had been long overlooked.

Graziers in the mid-1960s were active in establishing western branches of the Wildlife Preservation Society of Queensland in response to the extent of clearing. Southwood National Park, one of the few brigalow parks, was established in 1970 as a result of agitation by a local landholder who said at the time: "I wish we could keep some of this country just the way it was when I came here, so that my children can see it ..." (Webb, 1984).

Sir James, in opening the symposium, offered his insight that "not all the problems associated with clearing large tracts of brigalow have been solved and not all of the side effects have yet to be properly studied". How prescient of the explorer and the Governor, a century apart. Whilst not knowing the pathways leading to climate change or of other impacts from extensive clearing such as salinity, they both recognised the potential for significant environmental impacts.

Modelling by the CSIRO Division of Land and Water, commissioned 16 years ago by the Murray-Darling Basin Commission, demonstrated that a 10-fold increase in salinity in some groundwater flow systems could occur in the Queensland part of the Murray-Darling Basin due to the extent of clearing. Importantly, it was shown that there

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was only a narrow window available to take action to keep salt down in the soil profile (Dawes et al., 2003). This work also demonstrated the need for research into restoration to plan for multiple objectives or co-benefits, e.g. production, salinity, water yield, carbon capture, soil health and biodiversity. This is a legacy issue: who takes responsibility for further research and repair?

In 1985, the RSQ held a symposium on The Mulga Lands (Sattler, 1986), partially in response to the extensive degradation occurring. A paper to this symposium by Beale, Orr & Mills (1984) reported that over 30% of the south-west arid zone of the Mulga Lands was susceptible to degradation of soils and vegetation, and that nearly 10% was permanently affected (refer photos 1 and 2). It also was suggested that the rate of degradation had accelerated in response to droughts over the previous 20–30 years. At this time a substantial body of work into sustainable management was carried out by the Charleville Pastoral Laboratory which enjoyed funding continuity for long-term research and extension programs. The Mulga Lands Symposium conclusions are just as relevant today for all of Queensland's rangelands (see Attachment 1).

It was also highlighted that no national parks existed across the extensive Mulga Lands Bioregion. A park system plan for the whole bioregion (Purdie, 1986) was presented based on the use of emerging computer techniques that identified the most efficient way to capture the diversity of regional ecosystems in the least area (Bolton, 1986). Australia is now a leader in the conservation science of developing quantitative tools in designing representative park systems. In the early 1990s, the implementation of a large part of the Mulga Lands park system, based on such techniques, was the first to be achieved worldwide for a large bioregion. The significance of this was not lost when His Royal Highness Prince Phillip travelled to Idalia National Park to open it and Thrushton National Park as the first Mulga Lands national parks.

In 1986, the Presidential Address to the RSQ argued that a similar systematic approach to park selection should be taken state-wide (Sattler, 1986). One of the constraints was the lack of a comprehensive database of the state's regional ecosystems and the mapping of their distribution. In 1989, work commenced to delineate the regional ecosystems of each bioregion and to assess their conservation and reservation status. This work concluded 10 years later (Sattler & Williams, 1999), whilst the mapping of regional ecosystems across all bioregions was achieved by the Queensland Herbarium in 2017 after 28 years of sustained effort. This has been the leading ecosystem mapping program in Australia across such a large state.

In 1989, the incoming government's premier environmental policy was to double the national park estate based on securing representativeness of ecosystem diversity and other values. The decision was taken to focus on the rangelands as there already existed an effective conservation constituency to speak for coastal and rainforest areas. Few parks occurred west of the Divide, and these historically were focused on the 'scenic or worthless (from a pastoral viewpoint) lands'. From 1990 to 2000, state-wide representativeness of the park system increased from 32% to 69% (photos 3 and 4). This analysis of representativeness does not necessarily mean adequate representation for the protection of regional ecosystems and species. Significant gaps in Queensland's rangeland national park system remain across the Brigalow Belt, Mulga Lands, Channel Country, Desert Uplands, Einasleigh Uplands and Mitchell Grass Downs Bioregions.

To build protection and resilience for biodiversity, especially from climate change, will require a range of conservation actions including:

- (a) the development of a fully representative park system across all bioregions;
- (b) the protection of rare and threatened species and ecosystems, refugia and corridors on private and public lands; and

- (c) the embedding of protected areas into planning and managing sustainable landscapes.

The protection of arid and semi-arid wetlands is a key issue, especially to protect endemic species and the habitat of wide-ranging migratory avifauna.

In addition to their biodiversity value, the economic potential of these parks for tourism

is now important for regional communities. Such tourism is growing as more 'grey nomads' (retired travellers) in particular, often time-rich and interested in country, tour Australia. The development of rangeland policy must involve all stakeholders, including conservation and tourism interests, to garner sufficient societal support to provide incentives for ecologically sustainable management and the repair of natural capital.



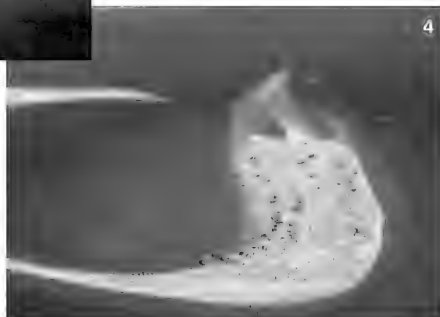
Loss of top soil, nutrients and native grass species.

Erosion to hard pan.



Welford National Park.

Large pelican rookery,
Currawinya National Park
(Photo: DEHP).



Defining both a private and public duty of care will be a key component:

- (a) to more closely identify responsibilities for sustainable management;
- (b) in defining public good issues beyond the requirements for sustainable management; and
- (c) in advocating for financial support.

The use of parks as benchmark areas could help in assessing condition and trend across a wide range of landscapes and in building mutual respect of various management objectives by all stakeholders.

Conclusion

To achieve ecological sustainability and the repair of natural capital will require an alliance of all stakeholders. The task is bigger than any one sector and requires a coordinated vision of sustainable pastoral use, nature conservation, tourism and other interests. Defining an appropriate private and public duty of care could provide a framework for sustainable management and for advocating

financial assistance. This would also inform approaches to tackling legacy issues surrounding degradation and the implementation of measures to protect ecosystem services and the public good.

Research into maximising multiple outcomes as part of restoration and the development of models for sustainable management is required. Secure funding is vital for long-term research and extension, and to provide continuity for staff. Research into reducing the salinity threat in the Brigalow Belt and restoration of degraded lands in the Mulga Lands are specific examples.

Despite significant advances in the early 1990s, major gaps exist in the implementation of a representative national park system across Queensland's rangeland bioregions. With increasing threats, especially from climate change, the implementation of a range of biodiversity conservation measures is required.

The RSQ as an independent scholarly body has made a significant contribution in the management of Queensland's rangelands through informing policy development and disseminating research findings.

Attachment 1: Mulga Lands Symposium Conclusions 1986

The Mulga Lands cover 20% of Australia and this symposium highlighted that it is one of the most fragile of the semi-arid and arid parts of Australia where substantial impacts from overgrazing by domestic animals and rabbits have occurred. It was discussed that this region must be managed within its capability and that other uses of mining, tourism and national parks could make substantial contributions to inland communities.

Specifically it was concluded that:

1. Protection of the natural resource to achieve sustained use be the paramount consideration of government and industry – land stewardship.
2. A land use planning framework be developed for balanced and sustained use of the Mulga Lands.
3. Greater effort be made to facilitate extension of management research information to landholders to assist in management.
4. Nature conservation, the establishment of National Parks and the promotion of tourism be planned as legitimate uses within the Mulga Lands.
5. Federal Government financial incentives were essential to achieve objectives of the National Conservation Strategy. Incentives should encourage sustained land use and implementation of nature conservation strategies.
6. Land administration, including property size, tenure review, and lease conditions should reflect land care and stewardship as its basis.

7. Rural stock routes represent an important land resource for multiple land use including nature conservation and recreation. Policies should be developed for their long-term retention and protection.
8. Drought relief subsidies do not encourage sympathetic land management and should be reviewed so as to provide an incentive for good management.
9. Land zoning and clearing guidelines be established to protect marginal and fragile lands.
10. Land care and stewardship become part of school curricula, the basis of extension services, and rangeland management be introduced into university and college courses.

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Author Profile

Paul has played a key role in the development of a representative national park system for Queensland's rangelands. He co-edited the identification of the state's regional ecosystems as a basis for conservation and natural resource planning and coordinated the Terrestrial Biodiversity Assessment of Australia. Paul is now a beekeeper.



Julia Creek dunnart (*Sminthopsis douglasi*), an endangered small mammal species recorded on Moorrinya National Park after its gazettal and the removal of stock grazing (Photo: DEHP after G. Mifsud).

Rural Debt and Viability: A Conference Summary

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Keywords: monetarism, monetary theory, Engel's Law, Say's Law

Introduction

Any serious analysis of economic policy must follow a standard framework comprising:

- Policy objective.
- Policy strategy.
- Policy outcome or performance.

Consequently, this summary supplements the major paper presented at the July Rangelands Dialogue which discussed the failure of post-1971 economic philosophies to address the needs of an agricultural sector in an advanced mature economy. Readers are encouraged to read the major paper, available on the Society's website.

Agricultural Policy Background

Post World War II, agricultural exports were an important source of foreign exchange under the Bretton Woods fixed exchange rate regime. Agricultural policy pursued a policy direction of industry protection and closer settlement. The policy strategy comprised orderly marketing of major industries and breaking up by ballot large leasehold properties as leases expired. Dams were built to facilitate development of intensive irrigation regions. The interventionist philosophy of J. M. Keynes underwrote both economic policy in general and agricultural policy in particular.

Following the collapse of the post-World War II fixed exchange rate system in 1971,

Australia slowly joined the international move away from Keynesian interventionist demand management policies to embrace monetarism and neoclassical economics of the market. Since 1983, Australia has structurally reformed the Australian economy to join the growing acceptance of free market global monetarism. Global monetarism had been developed over the late 1950s and 1960s by two former Chicago School economists, Robert Mundell and Arthur Laffer. Global monetarism is commonly and loosely referred to as globalisation.

Post 1971, agricultural policy moved from industry protection and closer settlement to a market-based direction of rural adjustment. In 1977, rural adjustment was cemented as the agricultural policy direction. Following the move to globalisation in 1983 and withdrawal of industry protection over 1988 and 1991, the policy strategy of rural adjustment concentrated upon promoting economies of scale to lift sectoral productivity, efficiency and international competitiveness. From 1993 onwards, rural adjustment, along with farmer self-reliance, has underwritten both agricultural and drought policies.

The principles of rural adjustment derive from the neoclassical supply-side free market economics of Thatcherism. Lame ducks are shipped out of the industry whilst enterprise is rewarded. The strategy has been consolidation of enterprises to capture economies of scale. The main policy instrument of rural adjustment

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has been concessional interest rates to reward long-term ‘viable’ enterprises. It should not be a surprise that the policy strategy of ‘shipping

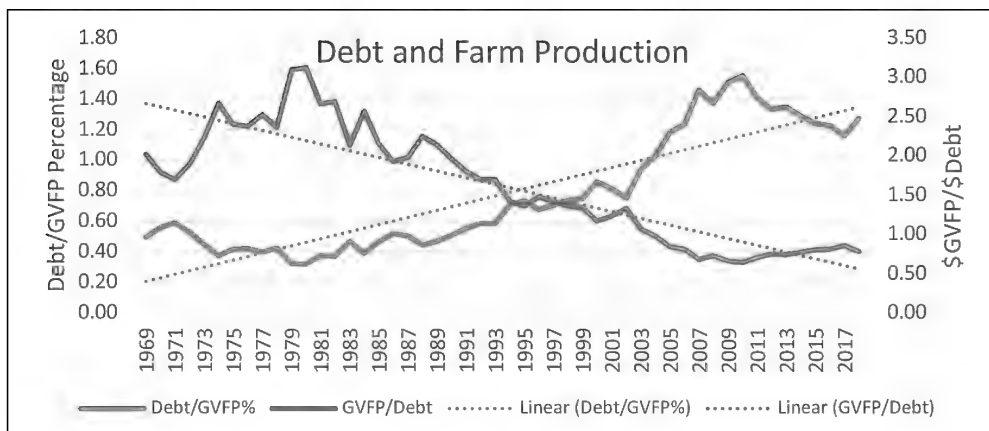
out lame ducks’ has had a profound effect upon both agricultural efficiency, employment and population.

Performance Indicator Outcomes

The statistics in Figure 1 indicate:

- Steeply positive orange gradient, long-term trend curve (Debt/GVFP).
- Orange curve suggests that production has been debt dependent.
- Steeply negative blue gradient, long-term trend curve (GVFP/Debt).
- From 1984, declining efficiency as debt relentlessly consumes production.
- In 1989, \$1 debt produced \$2.14 in output.

Figure 1. An empirical analysis of debt to output as a performance indicator of policy efficiency. The orange curve is Debt/Gross Value Farm Production (GVFP), whilst the blue curve is calculated by dividing GVFP/Debt.



Compiled from: ABARES Commodity Statistics 2017; and RBA Rural Debt Table D9 online 2018.

- By 2003–2004, \$1 of debt produced \$1 of output.
- In 2010, \$1 of debt produced 64 cents in production.
- From 1993 to 2013, sectoral performance lies below the negative-sloping blue trend curve.

By any reasonable assessment, rural adjustment has not delivered the theoretically expected outcomes from economies of scale, increased efficiency and rising productivity. Post 2003–2004, both curves identify debt-funded output as inefficient and unstable. Any other sector would have demanded a change in policy direction, but agricultural leaders appear to have genuinely believed the rhetoric of market theology that structuring economies of scale by reducing the number of farmers

would ensure long-term sectoral viability. That simplistic arithmetical approach by industry leaders, major political parties and commentators has been a gross violation of established economic knowledge.

Failed Policy Strategy Explained

Established economic theory readily explains the failure of rural adjustment as a conflict between two laws in economics: Say’s Law of Markets (1803) and Engel’s Law (1856).

Say's Law of Markets

Say's Law of Markets is commonly referred to as 'supply creates demand' and is particularly relevant to agricultural policy. In a 1995 publication, the National Farmers' Federation restates it in terms of commodities:

The downward trend in real commodity prices need not of itself produce a loss of national income nor a decline in the profitability of commodity producers if the decline in real commodity or manufactures price is the result of higher productivity (Brennan, 1995).

Say's Law of Markets is predicated upon an unrealistic assumption that all markets are purely competitive. A purely competitive market requires a number of strict conditions, one of which is that no one market participant can influence either supply or demand. The very structure

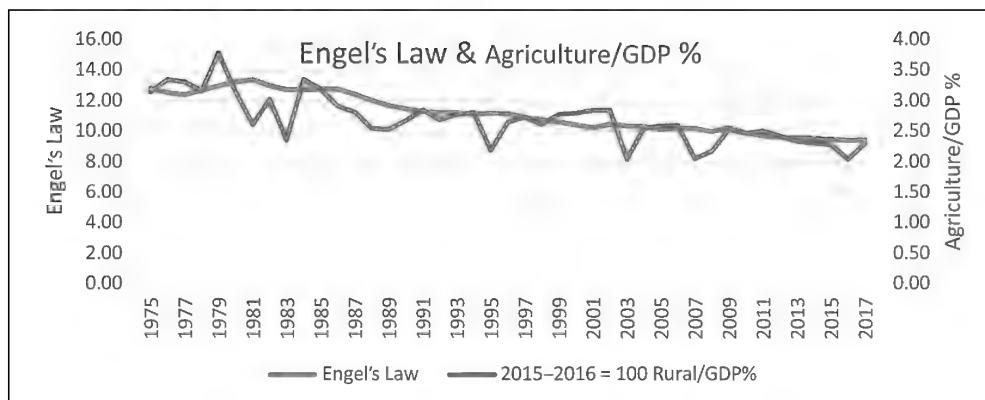
and direction of rural adjustment is designed to breach that condition.

Engel's Law

... as income grows the demand for food grows less than proportionately ... This Law of pervasive importance in economic growth ... [explains] ... necessity of the political importance of farmers to decline [as shown in Figure 2] (Kindleberger, 1973).

In 2011, Richard Anker from the University of Massachusetts, Amhurst, published a research paper (Engel's Law Around the World 150 Years Later) in which he argued that Engel's Law is just as relevant today as the day it was developed in 1857. Moreover, he argues that it applies equally to both domestic and international demand for agricultural products.

Figure 2. Engel's Law demonstrated.



Compiled from ABARES commodity statistics 2018, Table 3.1; and ABARES commodity statistics 1997, Table 23.

For policy to ignore Engel's Law ensured that at some point, applied market philosophies and internationalisation of Australian agriculture would fail the domestic agricultural sector. Empirical evidence presented confirms Anker's findings that Engel's Law overpowered Say's Law in the real world of Australian agricultural production (Anker, 2011).

Employment Performance Indicator

Employment decline in agriculture is euphemistically explained as technological replacement of labour. The populist solution to declining rural employment then becomes education and training in emerging technologies to build new industries and employment, which are expected to stabilise and rebuild regional economies.

Empirical analysis suggests that this is wishful thinking and a contradiction in terms.

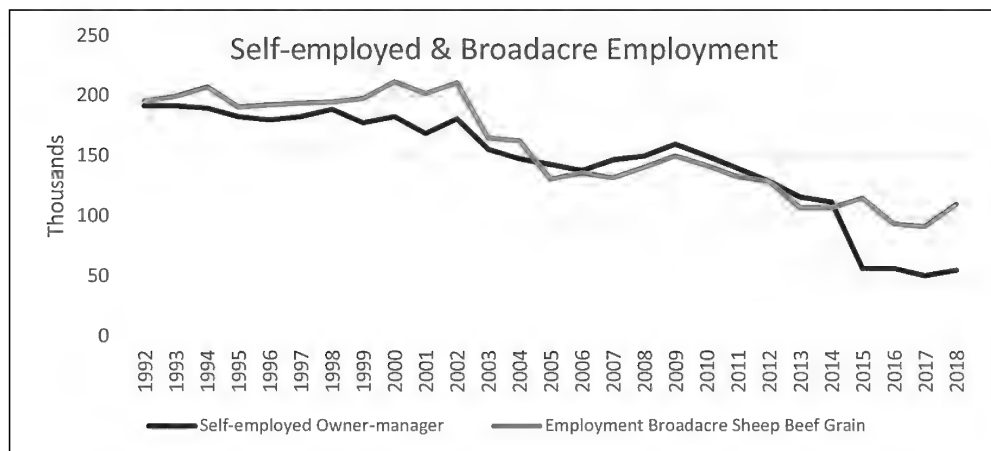
ABARES' commodity statistics for 2018 show agricultural employment peaking historically in 1990–1991 at 387,000 and falling to 279,000 in 2017–2018 (29%). Meanwhile, for Australia over the same period, employment rose from 7.8 million to 12.5 million (60.3%). It stretches the mind to think the decline in agricultural employment alongside such strong national employment growth is explainable by consolidation of farm size and applied technology. Agricultural policy needs to accept responsibility for this employment outcome (ABARES, 2018).

The reality is that structural industry reform began with the 1988 tariff reductions, which were ratcheted up again in 1991. Orderly marketing of major industries wool and wheat was discontinued over 1989–1990. It cannot be explained as mere coincidence that agricultural employment began to decline from its peak in 1990–1991 as a result of technological adoption by the farm sector at the same time structural reform of agriculture began in earnest.

Figure 3 demonstrates empirically that agricultural employment contracted strongly across broadacre agriculture and the self-employed small-scale farmer. Broadacre employment decline appears from 2002 coinciding with the worsening of the Millennium Drought; however, the real loss of employment lies in the self-employed and owner-manager classifications from 1992 onwards. The impact of the self-employed owner-manager is particularly important as that group comprised largely the part-time skilled labour force residing in rural Australia. Policy-driven rural adjustment – ‘shipping out’ small inefficient farmers – would seem a more logical contributor than technology.

- Long-term decline in broadacre employment: 52% between 1992 and 2018.
- Self-employed fall: 71.4% between 1992 and 2018 (192,000 to 55,000).
- Millennium Drought running from 1997–2009.
- GFC 2009–2013.
- 2013 + current drought.

Figure 3. Empirical demonstration that agricultural employment contracted strongly across broadacre agriculture and the self-employed small-scale farmer.



The decline in agricultural employment whilst employment in the wider economy continued to rise strongly is a damning policy indicator. If agriculture were likened to a private firm, a cleanout of the board, senior management and advisors would be expected.

Conclusions

Agricultural policy since 1983 has seen a redistribution of income away from rural producers:

- The move to monetarism and market-based agricultural and drought policies since the move to globalisation in 1983 has produced rural decline not witnessed since the days of the Great Depression of the 1930s.
- A theoretical explanation of rural decline lies in the incompatibility between two well-established laws in economics: Say's Law of Markets and Engel's Law.

- Engel's Law effectively redistributed agricultural income away from the primary sector to the secondary and service sectors.
- Say's Law of Markets assumes an economy structured upon purely competitive markets whilst Engel's Law describes an imperfect market structure.
- Contemporary agricultural policies structured upon Say's Law must fail in the real world of Engel's Law.
- Corrective policies must redress this established redistributive feature of agricultural production in modern advanced economies, otherwise living standards will continue to decline in regional Australia.

The question of equity – of some approach to equal treatment for all – is not less important than the aggregate income involved (Galbraith, 1976).

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Author Profile

Ben Rees is both a farmer and a research economist. Over the years he has been keynote and guest speaker at national and local rural meetings and conferences. A repository of his work is available at <http://benrees.com.au/>

Addressing Comprehensive Capital Run-down

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Keywords: returns to factors of production, systemic failures, capital renewal, regional Australia

Introduction

We are living in times of comprehensive capital run-down. Due consideration of all manner of capitals, from the built and financial to the natural, has been absent since it was assumed by some using economics that ‘the problem of production’ was solved half a century ago.

Returns to capital have been inadequate. Widespread depletion of all manner of capitals followed. Debts accrued as soils, people and ecosystems were inadequately renewed. Worn-down enterprise, natural and community capitals are now all too common.

Yet we still persist with clearly inadequate options. A dollar here or package there can never address deep problems. Significant changes are needed to meet the challenges of rebuilding sound enterprise, community and ecosystem balances. More insightful approaches to ‘the problem of production’ offer good returns to all manner of capitals and efforts.

Pervasive economic distress and capital run-down are succinctly discussed in this paper, with elements identified for effective turnaround. Principles, stances and agenda issues are listed before a brief concluding consideration of eco-renewals and capital rebuilding.

The immediate need is to recognise how foundational mistakes have perverted even the best-intended and resourced efforts, and to consider how to respond more effectively. The wider

need is to bring about significant change in perceptions, practices and policies. Key capitals may then be renewed.

Times of Flawed Thinking and Ignored Problems

The roots of many current problems were established over half a century ago:

One of the most fateful errors of our age is the belief that ‘the problem of production’ has been solved. Not only is this belief firmly held by people remote from production and therefore professionally unacquainted with the facts – it is held by virtually all the experts, the captains of industry, the economic managers in the governments of the world [who conclude that things] not going as well as they ought to be going must be due to human wickedness. We must therefore construct a political system so perfect that human wickedness disappears and everybody behaves well, no matter how much wickedness there may be in him or her (Schumacher, 1973).

These twin beliefs come into sharp focus in agriculture: with the “problem of production”¹ assumed solved, failures to produce must logically reflect wicked farming that can be purged by “a political system”² so perfect that wickedness disappears” (ibid.). Assumed is that problems in one “system” can be offset by perfection in

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another. Such beliefs were seen as widely applicable, including to financial and environmental problems. Naively assuming that paired systems can mutually co-regulate irrespective of context is risky in analysis, and demonstrably foolhardy in policy and practice.

Evident limitations in such thinking help explain why degradation of capitals goes effectively un-noted and unchecked. Policy operatives (private, operational and public) *systematically* discount any reports of damage, decline, degradation or despair as a righteous purging of wicked imperfections *in the other system*. Policy maladaptedness worsens while problems build unchecked and needed returns to capitals diminish.

In a nutshell, building an encompassing abstraction of an economy (cast as a perfect system) competed with understanding economic realities.³ The systems view prevailed with reality assumed conformable to abstraction. The neo-classical synthesis mathematically linked production and consumption via markets. Despite serious internal and logical problems, first- and second-generation neoclassicism dominated a century, with ‘new neoclassicism’ now a third-generation aspirant.

At heart, neoclassical analysis argues suppliers continue to supply markets as long as price exceeds *average variable cost*.⁴ Prices need not cover full measured enterprise costs. Further, not all costs may be accounted for, particularly if problems of measurement (notably for capitals), money value attribution, production factor mix or externalities exist. And they all do.

Not only was the problem of production not solved, but the preferred analysis was partial, logically invalid and misleading: financially unsustainable market outcomes became part of posited equilibria. Still, the system and dreams of neoclassicism held great appeal, notably to those who might so profit.

Not only did ‘the system’ render the complex as simple and automate policy setting around the kernel of productivity (which is logically

inadequate, especially in an open economy). It also sidelined people, government, nature and other third parties or capitals unless market failure was accepted.

Liberalisations gave much freer rein to particular interests while supply chain and industry concentration increased. In particular, legislative adjustments saw: the global rise of financialism (McGovern, 2019); historically very high debts (McGovern, 2011a,b); a propensity towards financial crises (Roubini, 2007; McGovern, 2008); and an ongoing Australian rural financial crisis (McGovern, 2014b) exacerbated by (to date) ever-extending drought or other natural disasters.

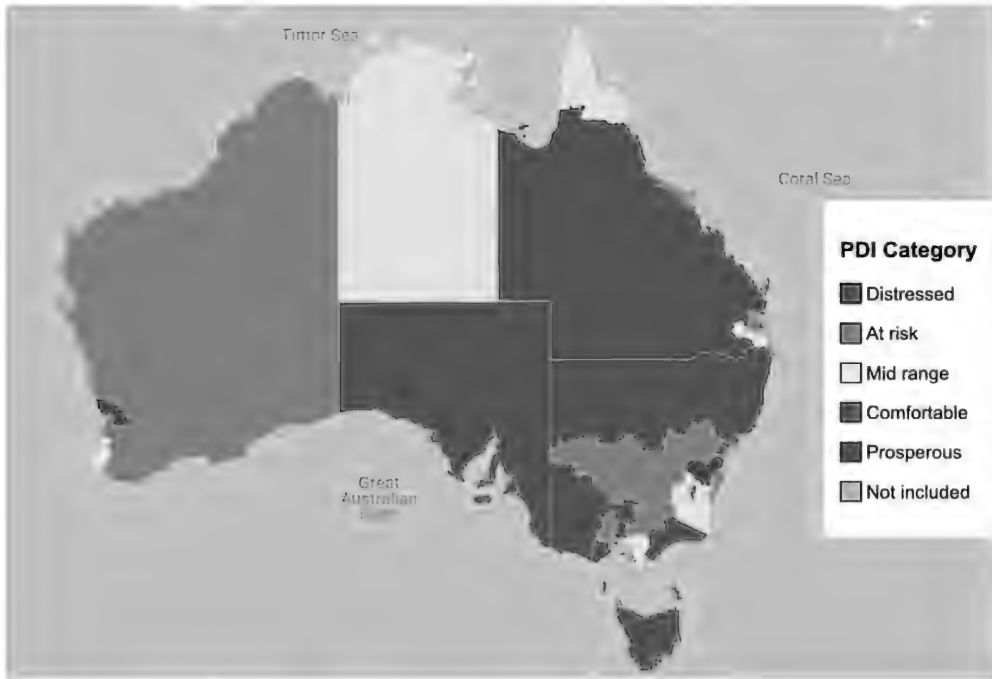
Across Rural Australia

Prosperity in Australia is concentrated in the major centres. Elsewhere, distress reflects the loss of many ‘value-adding’ enterprises and capitals as part of the decline in profitability of the rural sector. A top-level view shown in Figure 1 maps Federal electorate values of a Prosperity and Distress Index (PDI). The PDI is used to distinguish between communities that endure economic distress compared to those that achieve economic prosperity (Baum et al., 2019).

While variations do occur within electorates, the overall distress of major rural areas (including the bulk of the rangelands) is evident. Other works in this volume, such as that by Rees on populations and lost employment, help build a tragic picture of distress in once prosperous enterprises and communities. Research⁵, various field activities including with the Rural Debt and Drought Taskforce (Katter, 2016), dialogues as part of Rural Debt Roundtable (McGovern, 2013, 2014a) and public Inquiry reports (such as Hayne, 2018) detail significant dislocation and deepening distress.

Economic distress is driven by poor returns to economic capitals, be these human, built, natural, financial or other. Economies and their communities decline towards deep crises if real depreciation and capacity run-down are allowed to develop into an accelerating downward spiral.

Figure 1. Prosperity and Distress across Australian Federal Electorates (Baum et al., 2019).



This suggests five key points⁶:

- Drought has highlighted underlying (sectoral, regional and societal) imbalances as well as public and private policy deficiencies, so *foundational problems, not symptoms*, need to be addressed.
- We are living at the high-risk end of a long period of *capital run-down* across human, physical, financial, environmental and other styles of capital. Negative economic profits across agricultural sectors and rebalancing of government policies in ways that discriminated against rural and remote areas have driven decline in the rangelands.
- Inept use of theories and *malformed policies* is evident. Pop economics and dangerous strategies such as asset inflation drove decline and despoliation. Naïve competition policies, denial of trade realities and

theories, woeful regulation and polluting debts from unchecked Ponzi finance streams were all part of a self-reinforcing destructive logic, and still are.

- Much can be done to *restore* financial/economic/environmental/societal *viability*. Continuing the approaches, policies and ‘quick fix’ thinking that led to today’s problems will not solve anything. Rather, we need to sensibly build on what can deliver real results on the ground now and over the medium and long term, and so rebuild vital entities, communities and ensembles.⁷
- There are always losses (and gains), but losses today are needlessly high. *Key capacities* are seriously *weakened*, so it is past time for some fresh thinking and use of relevant insights.⁸ The challenge is to conserve and transition essential existing capacities while also developing well-distributed

needed new capacities. Timing and placement across public, community and private areas is part of the reconstruction of the social accord which underwrites efficient and equitable economic activity.

An unprecedented extraordinary cycle is now ending, locally and globally. Its hallmark is a progression of crises as evident in Australian (and other) rural areas over recent decades. These are now also increasingly evident in the cities.

However, misplaced beliefs still hold sway today. This inertia helps explain not only how current problems arose unchecked over many years but also why responses have been so limited. Community impoverishment, environmental degradation and societal fracturing consequently continue unchecked. Equivalently, comprehensive capital run-down continues unchecked.

Self-reinforcing delusions can be hard to change, especially when part of the conventional wisdom. As problems surface, some think it easier to double down on the system or our beliefs while reducing reporting and information flows so that *wickedness disappears*. History attests that problems then only grow unchecked. Failures cannot self-correct by using the policies and approaches that incubate them.

In passing, François Quesnay was, amongst other things, surgeon and physician to Louis XV of France. He was also an early economist who in 1758 published the *Tableau economique*, a descendant form of which Samuelson saw in the 1960s as offering a potential way around neo-neo-classical⁹ shortcomings.

Promising development research was done, including in Queensland and on agriculture, during the 1970s and 1980s, but dogmatic doubling down by the 'neo-neo-class' saw research findings ignored while productive lines of development stalled.

Louis' conservative son died on the guillotine in a revolution promoted by economic distresses exacerbated by state debts made markedly worse by financing an American war. Capital disputes

have all manner of resolution, and avoidance of crises sensibly requires apt thinking, tools and tactics.

Turnaround

Capital is essentially a stock with which we may variously engage in living life. It is of many types. It may be built by the efforts of humans and wider nature, and also so depleted. Capital availability offers choices with impacts consequent on all manner of organisms, whether it be drinking from a stream to support life today or storing gathered foods in anticipation of adverse times.

Capital usage necessarily links stocks and flows as we draw down or build up stock levels and/or quality, typically as part of some event. For Harcourt & Laing (1971), "capital theory became relevant when the problem of the choice of technique, and the explanation of distributive shares and of productivity change over time, both theoretically and empirically, were discussed". Clearly, relevant contributions should be sought from capital theory, and other areas.

Capital maintenance requires suitably balanced flows so as to maintain the stock quantity and quality. Production which is transformative allows us to enhance capitals, and enhancement offers prospects that we may assess as good, bad and otherwise. Capital enhancement drives development, as the ongoing contributions of your own stock of cumulative learning from experiences to your personal development, capacities and functioning attest.

People routinely mix and combine capitals over various time horizons at work, home and play, with all manner of effects. Persistent interdependencies arise, and obligations may be imputed so as to allow maintenance and development, or not, of all manner of capitals.

The brilliance of neo-neo-classicism was to imagine a way to systematically combine all such things. The folly was to assume any such system autonomous, perfectible and fully inclusive. The key mistake was in uncritically seeking

to implement both. The resultant tragedy is the parlous position of too many capitals, and of those dependent on them.

Complications obviously arise when, for example, imputed obligations unexpectedly cannot be met. This was recently posed as an unanswered question by Commissioner Hayne: “How are borrowers and lenders in the agricultural sector to deal with the consequences of uncontrollable and unforeseen external events?” (Hayne, 2018, p. 242).

The wider issue can be posed as: how are capital stocks and flows to be well managed and developed over all manner of events and uncertainties? Articulating ‘well managed and developed’ into a prudent approach is the central challenge on many levels. Approaches involving mutuality, stewardship and well-grounded decision making can do what competitive markets and perfect systems by design do not, and cannot do.

Avoidance of needless destruction of capitals and key capacities is pivotal in stabilisation and any successful turnaround. Rectification via effective transitions with sound outcomes properly involve inclusive:

- recognition and *remediation* of foundational flaws;
- *rebalancing* and capital rebuilding;
- apt knowledge, dialogues and policies yielding well-formed *responses*;
- *restorations* of viability and vitality; and
- insightful approaches and efforts that underpin *robustness* of enterprise and capitals.

For those still awaiting a market correction, remember to tell your family, colleagues, and friends: “The market can remain irrational longer than you can remain solvent” (attributed to Keynes).

Rectifying Imbalances in Finance, and in Other Capital Usage

Finance is a good area to start as it is a fully human creation with pervasive effects on all

manner of capitals. It is an area that is conceptually easy to modify, and if there is a sufficient will, acceptable ways will be found to stimulate and expedite needed rebalancing.

Financial imbalances can derive from a variety of causes, including systemic capital misallocation as in this example:

And [in the minutes of Rural Bank Credit Committee meeting of 17 August 2011] at 0075 we see that the chairman noted that:

A presentation was made approximately five years ago which highlighted that the value of Queensland cattle properties were heading into a pure asset bubble, and these warnings appear to have been ignored (Orr & Gartmann 2018).

An asset bubble arises when the ratio of the value of productive capital assets to likely income is excessive. Assets will be traded as such prices only if speculation is present.

As this Royal Commission witness relates, the Rural Bank was aware in around 2006 that, *at issue*, income to service any Queensland beef property loans issued would be likely insufficient. Other banks should have been aware, and like bubbles existed in other areas of agriculture. The Commissioner chose not to pursue this extremely serious issue.

Yet senior bankers and policy bureaucrats declared ‘no problems’ in front of senior responsible Ministers on two occasions (in 2012 and 2015) when I was present, and I suggest likely other occasions. APRA’s evident awareness was not related to government it appears. Clearly, proper Inquiry is needed.

There is ample evidence of serious systemic problems in finance, persistent denial and comprehensive failures to responsibly respond for many years. There are also available insights, methods and past experiences that demonstrate how to prudently respond. Capital distress and needlessly ruined lives and lost capacities will continue until viable capital balances are restored across all capital types.

Currently, returns to financial capitals are excessive, degrading the returns to other capitals. Excessive debts pollute. Denial ensures degradation spreads and accelerates. Doing nothing ultimately impoverishes all, including the dominant beneficiaries of neo-neo-classicism and ascendant financialism.

Principles that would be prudently publicly adopted in Australia include:

1. Government is not a bank, and should not use its balance sheet to act like one.
2. The Reserve Bank of Australia (RBA) is a *public* bank with an apt but neglected charter of responsibilities.
3. Development which requires long-term patient finance is the core business of development banks.
4. Loan distressing and reconstruction are part of balance sheet rectification, on all sides.
5. Orderly workouts are better than panic, hubris and fire sales.

6. Principles, policies and practices that incubate problems will not solve them.
7. Transparency, mutuality and subsidiarity aid robust, inclusive evaluations and successful investment.

Financial stresses are complex, but skilled interventions can make a real difference. The scale of targeting to rectify imbalances ranges from enterprise to nation depending on 'goodness of fit' criteria along with current and potential capabilities. In a nutshell, as the emphasis moves from unchecked capital consumption to capital (re-) development, the use and abuse of all manner of capitals returns to being a central ongoing concern.

Stances will variously need changing, with an overall move from 'damaging' to 'restorative' as a means of rebuilding the common wealth and individual prosperity of thriving Australians. To illustrate, consider some Stance Attributes cast for finance which have immediate and wider application.

Alternative Finance Stances: Damaging and Restorative

Damaging	Restorative
Denial	Honesty
Overlooking key contributing factors	Recognition of factors beyond control of parties
'All your fault' attributions for failures	Shared responsibilities for rectifications
Secrecy	Transparency
'Letter of the law' contract dealings	'Spirit of justice' contract resetting
Entitlement of banker 'rights'	Due recognition of all party interests
A private interest dominates	Public interest accommodated
Asymmetries unchallenged	Power and other imbalances recognised
And more ...	And others ...

Agenda items are many, with many well suggested in rangelands conference discussions and this publication. However, positioning, analytic and evaluative frameworks that are 'fit for purpose' are needed, along with people who are not only willing but skilful for the many and often critically interlinked jobs at hand.

Some agenda recommendations to advance the seven listed Principles include that:

1. Commonwealth farm loan funds currently made available to temporarily ameliorate (but not solve) severe balance sheet strain could be diverted to rural capital stabilisation and restoration of natural assets, including via stewardship projects with demonstrable public outcomes using decoupled income support¹⁰ arrangements. These and other options open to responsive

State or Commonwealth government are World Trade Organisation compliant.

2. Public reconstruction and development banking activities be responsibly re-instituted and coordinated by the RBA so as to organise and resolve rural financial matters constructively and equitably. Historically these have been key responses in dealing with 'the consequences of uncontrollable and unforeseen external events' and so resolving Hayne's unanswered question 'after the event'. Currently touted 'before the event' approaches are demonstrably unworkable so better options available need to be evaluated, as applied as apt.
3. Development bank lending to underwrite needed industry and infrastructure developments be carried out using suitably structured banking arrangements, prudent investment evaluation and financial products that are fit for purpose given uncertainties and investment needs.
4. Borrower and lender balance sheet imbalances be monitored with, in the case of persistent or worsening strains, timely and prudent financial reconstruction allowing restoration of enterprise financial vitality.
5. Orderly workouts which prioritise conservation of key capacities and avoid needless destruction of capitals be standard market practice across the full life of any investment.
6. Solutions to problems of production be targeted in policy and practice in an ongoing way so as to optimise investment evaluation and realisations.
7. System and market failures in the context of an open economy, both as evident and as likely, be addressed with particular attention to transparency, mutuality and subsidiarity so as to improve evaluation and investment processes and outcomes.

Improved balance sheets and capital positions are the overarching goals of all seven. Balance

sheet resets which benefit borrower, lender and community by apt enterprise revitalisation are clearly superior to current denial with deepening debt-deflation depression.

Conclusion

We argue that at the heart of the correct response to high unemployment, is expenditure on improvements in physical and human capital, with an emphasis on green friendly projects and that this should be financed by borrowing and usually by borrowing from the Central Bank ... (Harcourt et al., 2013).

Prudently funded investments that rebuild key capitals and capabilities drive economic development and the renewal of community prosperity and viability. Stakeholders in mutually beneficial relationships that sensibly allow for risk and uncertainty can drive economic turnaround.

Re-establishing apt ways of linking capital positions and returns, over time and events, to investments and development is both a conceptual and practical challenge. Neoclassical abstractions are not up to the task due to logical and conceptual problems evident in the formulation and the singular approach employed. Recognising that a variety of feasible capital combinations can produce desired products and capital formation or renewal promotes prudent choices by investors, operators, regulators and other engaged parties. 'Fit for purpose' arrangements need to replace 'one size fits all' dogma with its neglect of real profit and capital issues.

New business and policy modes are needed to address current stresses, debts and run-down. Entrenched multi-faceted problems require a range of new capabilities, some of which have been outlined. However, it would be particularly tragic if ongoing denial or a rushed effort by some advocating further refinement of existing flawed approaches and non-delivering policy products was seen as in any way reasonable or

responsible. We can do better, but the time is short as damage to key capitals is deepening and accelerating.

Just as Mutually Assured Destruction (MAD) arguments moved the world away from nuclear war options, so also MAD capital threats need to be sublimated with capitals applied more beneficially and profitably elsewhere. All stand to gain, as do all manner of capitals.

Rural areas, particularly the rangelands, will benefit as we address the challenge of subprime agriculture (McGovern, 2014b). Parasitic finance culminating in disorderly workout, typically

via inequitable firesales, is needlessly damaging. Financial reconstruction provides ways back towards prosperity through capital adjustments and reinvigoration. Orderly workouts can be complemented by new capital rebuilding opportunities, as occurs when farm stewardship realises renewal of the varied capitals used in, and affected by, the production process.

I look forward to engaging with those who would like to work on initiatives that have a good chance of rectifying capital imbalances, destressing overburdened balance sheets and achieving good capital development.

Endnotes

¹ Broadly, the problem is how we make “best use of resources to meet human needs” by making products. That a solution had been found was an understandable assumption when Schumacher published in 1973 as the previous quarter century had seen an historic, widespread advance in material prosperity. This was supported by a regime of well-set policies, international arrangements, technologies and “economic systems”. However, limitations went unheeded. So while many understandably considered that past successes would continue, monetary and economic crises broke out. These reflected unresolved stresses in resource usage, observable as major unaddressed capital imbalances. Current crises similarly reflect unaddressed capital problems. It is just the mix and manifestations that have changed.

² A system is an ideal form: a whole of many interacting parts. Typical dual claims of ‘the whole being (in some ways) more than the sum of the parts’ and ‘the parts fitting within the whole’ signal ambiguities and complexities that proponents too often ignore.

³ The conflict was most intense over the nature and treatment of capital. Capital was made conformable to markets by those centred at MIT in Cambridge MA while the (differentiated) nature of, and timing of returns to, capital mattered to those centred around Cambridge University UK. Harcourt & Laing (1971) provide details. While MIT’s Samuelson (1966) “admitted the logical validity of the British critique of the neo-classical theory of capital. ... the debate [became] largely a sideshow to the core of neoclassical analysis” (Tsoulfidis, 2008). Oversimplification won, with returns to capitals, and their attendant condition, excluded by the modal economic system. Consequences of this oversimplification of the economic system are increasingly evident.

⁴ The usual statement (routinely taught in Introductory Economics) is that competitive market equilibrium occurs where marginal revenue equals marginal cost *and* price is above average variable costs (or $MR = MC$ and $p > AVC$).

⁵ The problem is long standing, broad and deep (as discussed for example in McGovern, 1997, 1999a,b, 2000b). Building on “Four Key Points” in part of the 2018 RAPAD submission to the Queensland Drought Program Review.

⁷ Viability is an ability to live. This is today typically considered in the abstract, using measures, ratios and abstractions in a propositional or formal manner. Formal systems which by design target protocols will likely struggle in situations that are unusual, or beyond their design brief. Cambridge MA centred on highly formal systems which promote viability by conformance (which might include to capital/labour or asset value/income ratios deemed optimal). Questions of ‘how?’ go largely unaddressed.

Vital entities or ensembles live, and so act and adapt situationally. Cambridge UK recognised not only the variety of ratios “in real life and times” but also the consequences of various ratios, some of which would signal the need to adapt if the entity or ensemble was to remain vital. The ‘how?’ question is then central.

- ⁸ To name a few, we can draw from: successful restructuring and development efforts (past and present); conditions that foster enterprise successes in agriculture, including in past Australian experience; industry theory and production realities (and the impacts of their avoidance by market theorists and concurring analysts); public inquiries including the 2019 Senate Inquiry into Jobs in Regional Areas, and Hayne (2018, 2019); and how past financial arrangements fostered the development of agricultural capitals, including relevant imbalances.
- ⁹ Using the neo-classical synthesis, economists were able to link production and consumption via markets through a series of interconnected equation sets (and hence the predisposition to mathematical exposition). The market became the focal active unit, with production and consumption as passive adjusters (and hence for any product type, the centrality of market prices coordinating production and consumption).
- ¹⁰ “Support for farmers that is not linked to (is decoupled from) prices or production” (WTO Glossary). Stewardship can fit. In the EU, for example, “the ‘green direct payment’ (or ‘greening’) supports farmers who adopt or maintain farming practices that help meet environmental and climate goals. Through greening, the European Union (EU) rewards farmers for preserving natural resources and providing **public goods**, which are benefits to the public that are not reflected in market prices. EU countries have to allocate **30% of their income support** to ‘greening’” (European Commission, 2019). Australia could easily do likewise. It is just a matter of recognising the public will to act.

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Author Profile

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Longer-term Issues in Queensland Rangelands – An Economic Perspective

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Keywords: pastoralism changes, beef consumption, climate change and international organisations, climate change and financial institutions, social cost of carbon, green bonds

Introduction

Short-term issues tend to dominate discussion of the rangelands, but longer-term issues relating to declining consumption of beef and climate change are explored in this paper. Climate change is explained as the existence of large-scale externalities from the use of fossil fuel. Climate free of negative effects is an international public good which requires combined international cooperation to achieve and maintain, especially as the ‘free-rider’ problem acts to prevent this. The nature of economic models of climate change is explained. Although national governments have been loath to commit to international cooperation, international financial organisations such as the International Monetary Fund and The World Bank recognise that climate change is a serious and important problem. Together with national financial regulators such as the Bank of England, these financial bodies have determined that climate change is to be seen as presenting financial risks from the destruction of assets resulting from extreme weather events and the transition to a carbon-neutral future. Consequently, financial institutions are reluctant to insure some events and locations. Moreover, banks assess positions relying on fossil fuels more strictly, leading to unwillingness to provide finance for certain projects and industries. However, an increased supply of finance to industries in transitioning to a carbon-neutral future is available, and new

sources of finance for the same purpose are becoming available. Pastoralism on the rangelands finds itself faced with these risks and the prospect of being denied insurance and bank finance.

The Rangelands Declaration (in these *Proceedings*) identifies an agreed position of industry, natural resource planning and the science of the situation facing the rangelands and their communities:

Ongoing decline in these communities due to unrelenting economic pressures, a legacy of unfortunate planning and legislation, and the lack of bold, forward-looking policy choices;

The compounding effects of a highly variable climate that is expected to become hotter and increasingly variable, with more severe episodes of flood and drought, and persistent ecosystem stress.

This analysis takes up these two issues: first, the economic pressures shaping the long-term development of the beef industry; and second, the economic issues with climate change. Economic analysis of climate change is based on the identification of climate change as market failure; burning fossil fuels has a negative externality, and the agents burning fossil fuels do not pay the full economic price of their activity but reap the profits from that activity. The economic solution is to place a price on greenhouse gas emissions

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by a carbon tax. Further economic analysis has to determine the benefit of this intervention via a benefit cost analysis. The response of national governments to calls for coordinated international action has been tepid at best and hostile at worst. However, an interesting development has been the acceptance by the international financial sector of the seriousness of climate change and its seeing climate change as a trend giving rise to financial risks that have to be dealt with through established financial processes. This change has been driven by financial regulators whose actions can cause financial entities to adopt more serious attention to assisting the move to carbon-neutral economies.

The economic importance of the rangelands includes the production of beef. Cattle production, as well as providing for the domestic market, is oriented to the export markets of live cattle and processed beef. Long-term dietary changes, such as a switch by consumers from red meat to white meat and an increasing adoption of vegetarian or vegan diets, place downward pressure on the domestic market demand for beef. Increased concern for animal welfare is an influence on the export market in the long term. Calls for dietary changes towards plant-based foods rather than animal foods, to offset the effect of climate change, may have a negative effect on export demand.

Major short-term issues are the highly variable and severe weather conditions of floods and drought. In early 2019, North Queensland experienced severe flooding which resulted in significant economic loss including the loss of over 600,000 cattle and 1500 kilometres of fencing. Longer-term issues include identifying the adaption strategies to both of these weather events to achieve sustainable management when climate change is predicted to exacerbate extreme weather events.

Current Pastoralism in the Rangelands

The major economic activity in the Queensland rangelands is pastoralism. As of 2018, there were

11.9 million cattle, 50.0% of the Australian total, and 2.2 million sheep, 3.1% of the Australian total (ABS, 2019). Major areas of beef production in Queensland are the northern area which specialises in cattle breeding and the live export trade, manufacturing beef and cattle fattening; and the southern area which fattens cattle for processing and export as boxed beef (Queensland Department of Agriculture and Fisheries, 2018).

Most enterprises are family owned, but there are some large corporate bodies such as the Australian Agricultural Company which is listed on the Australian Securities Exchange. Beef processing is highly concentrated, with three major firms accounting for 65% of the market (Meateng, 2018). Cattle have traditionally been traded in saleyards, but their importance has been eroded by vertically integrated beef supply chains.

Dietary Changes

Consumption of Beef

Over the period 1974–1975 to 2016–2017, consumption of meat in Australia has increased from 109.8 kg per person to 110.2; however, the composition of consumption has changed markedly. In the beginning of the period, beef accounted for 63.4 kg per person, but at the end date only 25.4 kg, a decline of 60%. The proportion of beef in total meat consumed fell from 58% to 23%. Lamb and mutton declined from 23 kg to 8 kg, a fall of 67% over this 42-year period. Pig meat consumption increased from 9 kg per person to 25 kg, a change of 64%, while chicken increased from 10 kg per person to 44 kg, an increase of 76%. The implication of these changes for the beef industry is that it has become relatively more reliant on exports (ABARES, 2018).

Vegetarianism

There has been a consistent trend in Australia for people to consume diets that are predominantly vegetarian. In 2012, 1.7 million people (9.7% of the population) identified as vegetarian; in 2014, 2.2 million (11.2%) did so and, in 2018,

2.5 million (12.1%) so identified (Roy Morgan, 2019). Nearly 2.5 million Australians (12.1% of the population) now have diets in which the food is all, or almost all, vegetarian, up from under 2.2 million (11.2%) in 2014; this continues the trend shown in previous surveys.

Animal Welfare

Surveys find that there is increasing concern about animal welfare in Australia. Futureye (2018) found over 90% of people consider farm animal welfare a concern. The level of concern is mainly determined by awareness of specific animal and agricultural practices, heightened by more media coverage into such issues as live export transport conditions and battery cage chickens. People also express distrust of the industry and government when it comes to the welfare of farm animals. This distrust seems to be fuelled by the perception that there is a lack of transparency and that certain information may be kept hidden intentionally, or deliberately obscured (Futureye, 2018).

More Effective Management of Crown Land by Reforming Pastoral Leases

Pastoral leases have a long history in Australia, being designed to promote pastoral pursuits. The land under pastoral lease is a public asset, and it is the responsibility of the Queensland Government to manage the lands for the benefit of the ultimate owners of the land, the people of Queensland. Over 60% of Queensland's rangelands is held under pastoral lease tenure from the Queensland Government. Pastoral leases were designed to promote pastoral production through providing an adequate economic living area. The current form of pastoral leases may not be suitable in circumstances of major climate change. Negotiated new lease conditions and new types of leases could encourage adaption to climate change and incorporate policies to allow regeneration of pastures to absorb carbon and to provide economic stewardship of ecosystem services across the rangelands.

Economic Insights into Climate Change

A landmark report on the economics of climate change was the Stern Review (Stern, 2007), although there was earlier work on the economics of climate change, especially Nordhaus (1991). The extensive and detailed Stern Review received extensive international attention. The Review accepted the scientific findings on climate change in the following terms: "The scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response." The overriding finding of the Review was "that the benefits of strong and early action far outweigh the economic costs of not acting". Using economic models, the Review estimated that the costs of action to reduce greenhouse gas emissions to avoid the worst impacts of climate change could be limited to around 1% of global GDP annually. This is a material cost but contrasts sharply with the estimates of damage, which could be expected to reach 20% of GDP.

An important insight was that the Stern Review considered climate change to be the greatest market failure of all time. This result exists because burning fossil fuels create a negative externality, i.e. costs which are not borne by the economic agent burning the fuel but have to be met by the community at large. The solution to this problem is for governments to impose a carbon tax on the use of fossil fuels to ensure that the activity of burning fossil fuels meets the full economic costs. Without a carbon tax, private decisions to use fossil fuels will ignore the negative effects and use too much fossil fuel.

William Nordhaus, who shared The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2018, concluded his Nobel Lecture with four steps for today:

1. People must understand the gravity of global warming. This involves intensive research and resisting false and tendentious reasoning.
2. Nations must raise the price of CO₂ and other greenhouse-gas emissions.

3. Policies must be global and not just national or local.
4. Rapid technological change in the energy sector is essential.

Nordhaus points out that climate without negative effects is an international public good which all nations can enjoy, even if they do not pay the costs of ensuring the climate is free of negative effects. An international public good has the characteristics of non-rivalry in consumption, i.e. consumption by one nation will not reduce consumption by any other party; and non-excludability, i.e. it is not possible to exclude one nation from enjoying the good climate. The difficulty with creating an international public good is the free-rider problem, such that one nation may not pay their share of the costs but still enjoy the benefits. It is to the selfish advantage of each country to be a free-rider; if all nations act in this way, no agreement can be reached to create and maintain the international public good. The standard response of a free-rider is to claim that its emissions are small in relation to total emissions, e.g. say 1.3%, so it doesn't matter if this nation doesn't meet its share of the costs. If other nations take this attitude, no agreement for united action is possible. Nordhaus proposes as the solution the creation of a club: nations join a climate change club, and those refusing to join are subject to economic sanctions decided by the members. Sanctions could take the form of, for example, tariffs on the free-riders' exports.

Economic Models of Climate Change

Economic models of climate change are in a class of models referred to as the Integrated Assessment Model (IAM) which, as its name suggests, assesses the costs and benefits of climate change. There exist a large number of IAMs; the most famous is the Dynamic Integrated Climate and Economy model (DICE), developed by Nordhaus (2018). DICE is a highly aggregated dynamic growth model (a somewhat less aggregated model is RICE, where the "R" is

for regional) which incorporates a damages function derived from the scientific climate change model to calculate endogenously the damages from climate change.

DICE is dynamic, i.e. all variables carry a date (most economic models are comparative static and analyse a parameter shift or a change in exogenous variables to determine the result of the induced change on endogenous variables). General equilibrium models, widely used in economics, are comparative static and do not show the path of adjustment. Economic output is determined by an aggregate production function, and the damages caused by climate change are modelled as a quadratic function of the rise in temperature. Damages can be reduced by expenditure on the abatement of climate change. The essence of DICE is to maximise economic welfare, which is increased by increased output but reduced by damages. The two major uses of DICE are to calculate the social cost of capital (SCC) and to evaluate the different policy prescriptions. In 2018, Nordhaus reported a carbon price of US\$50.00 per tonne of carbon, which is much higher than existing carbon taxes; this reflects the loss of time in implementing significant carbon abatement schemes after the warning was sounded by Stern in 2007. More recent calculations (IMF, 2019) put the preferred carbon price at US\$75.00. The point of the carbon price is to increase the cost of products produced by burning fossil fuels. This will induce economic agents to switch from these products to one which uses less fossil fuels. The criticism of a carbon tax is that it may disadvantage low-income earners, especially in the transitional period. As a carbon tax would raise substantial revenue, it is open to subsidise low-income earners, to subsidise the production of alternative sources of energy from renewable sources, or to reduce other taxes. Implementation of a carbon tax does not necessarily imply an overall increase in taxation as there is a general agreement that the proceeds of a carbon tax could be returned to low- and medium-income earners. An important

implication of Nordhaus is his characterisation of a climate which does not produce damages as an international public good. The public good requires international cooperation and some mechanism to avoid the free-rider problem under which the selfish response is not to contribute to solving the climate change problem but to accept the benefits.

Estimates of SCC (Social Cost of Carbon)

The standard units of emission costs and benefits are dollars per tonne (1000 kilograms) of CO₂ emissions avoided. The social cost of carbon is an estimate of the net present value of monetised social damages from emission of an additional tonne of CO₂. An estimate in 2017 by the US government, under the Obama administration, gave the social cost of carbon as approximately US\$46.00 in 2017 dollars for a tonne of emissions. The effect of burning one gallon of petroleum gasoline produces roughly nine kilograms of CO₂, so a social cost of carbon value of US\$46.00 per tonne of CO₂ corresponds to US\$0.41 per gallon. Carbon dioxide is only one of many greenhouse gases; others include methane, nitrous oxide and hydrofluorocarbons. It is conventional to convert costs for reducing non-CO₂ greenhouse gases into CO₂ equivalent units.

Role of Financial Sector

It is clear that there is resistance by some nations to entering into binding arrangements to reduce the effects of climate. The IMF (2019) claims: “Limiting global warming to 2°C or less requires policy measures on an ambitious scale, such as an immediate global carbon tax that will rise rapidly to \$75 a ton of CO₂ in 2030.” This contrasts sharply with the fact that “the average price on global emissions is currently \$2 a ton, a tiny fraction of what is needed for the 2°C target”. In the absence of international agreement and coordination, there are developments in the financial sector which ensure that there are changes to increase the costs of ignoring climate change.

Regulators, which have oversight of banks, insurance companies and pension funds, have moved to the position that climate change must be treated as a trend superimposed on the existing cyclical variations in weather. In addition, regulators consider that climate change involves financial risks which financial institutions must take into account in their business operations. The risks arise firstly from extreme weather events which increase losses: clearly, insurance companies can be expected to experience higher losses from floods, hurricanes, cyclones and other weather disturbances; banks will find that the value of the securities as collateral for loans will reduce in value, threatening their profits and stability; and pension funds, which take a long-term view of investing, will divest their portfolios of investments which rely on fossil fuel consumption and will be unwilling to enter into new investments the basis of which is fossil fuels. Secondly, financial institutions see risks in the transition to a low-carbon economy, being wary of ‘stranded assets’ such as coal-fired electricity plants. However, the new view from the financial sector is not all negative; profitable business opportunities are seen to exist in the transition to low-carbon economies such as alternative energy, local energy networks and electric vehicles.

Green Bonds

In November 2008, The World Bank issued a new financial product, a Green Bond, a fixed-term debt instrument. Innovative features of the Green Bond were the provision of criteria for eligible Green Bond projects and the assurance, through a second-party opinion, that eligible projects would address climate change. Standards for Green Bonds were coordinated by ICMA, the International Capital Markets Association. The World Bank has raised the equivalent of US\$12.6 billion through 150 Green Bonds in 20 currencies (World Bank, 2019).

In 2014, The World Bank issued the first Kangaroo Green Bond, denominated in AUD.

This issue was taken up by a number of investors including four Australian fund managers, an insurance company, QBE Insurance Group Ltd and two superannuation funds, Local Government Super and UniSuper. UniSuper had been refining its Socially Responsible investments to include Green Bonds. Overall, 42% of the bonds were placed with asset managers, 35% with superannuation funds, 20% with insurance companies and 3% with banks. The geographic distribution was: 77% of the bonds placed with Australian investors; 10% with investors in Japan; 2% with investors in Asia; and 11% with US investors (World Bank, 2014).

UK Regulators' Response to Climate Change

In the UK, the major regulators of financial institutions, the Prudential Regulation Authority (part of the Bank of England), the Financial Conduct Authority, the Financial Reporting Council and The Pensions Regulator, in a joint statement in July 2019, stated: "Climate change is one of the defining issues of our time. We recognise it presents far-reaching financial risks relevant to our mandates."

The Bank of England's strategy for responding to climate change is:

- to engage with regulated entities on climate change risk; and
- to enhance the resilience of the UK financial system to climate change by supporting an orderly market transition to a lower-carbon economy (Scott et al., 2017).

Task Force on Climate-related Financial Disclosures

Further action is being taken by the private sector under the Task Force on Climate-related Financial Disclosures (TCFD) sponsored by the G20. TCFD's recommendations about disclosure on climate change are being followed by corporations whose balance sheets total US\$120 trillion. Eighty per cent of the top 1100 G20 companies now disclose climate-related

financial risks, while investment managers with 45% of global assets under management now support shareholder action on carbon disclosure. The Bank of England states that almost three-quarters of banks are starting to treat the risks from climate change like other financial risks, rather than viewing them simply as a corporate social responsibility. Banks have begun to consider the most immediate physical risks to their business models: from the exposure of mortgage books to flood risk to the impact of extreme weather events on sovereign risk. And they are taking steps to assess exposure to transition risks in anticipation of climate action. This includes exposure to carbon-intensive sectors, consumer loans for diesel vehicles, and mortgages for rental properties, given new energy efficiency requirements.

Australian Prudential Regulation Authority (APRA)

In Australia, the Australian Prudential Regulation Authority (APRA), the regulator of financial institutions, has expressed its position on climate change in the following terms:

Over recent years, APRA has highlighted the financial nature of climate change risks to its regulated entities. APRA has advised that these risks are material, foreseeable and actionable now. Awareness and understanding of these financial risks have clearly increased during this time. A critical paradigm shift has occurred due to the work of industry, domestic and international supervisors and regulators, as well as other key stakeholders. Climate change is increasingly seen as a material prudential risk. A shift from awareness towards action in response to these risks is underway.

A survey of 38 large regulated entities (most of the financial sector) undertaken by APRA in 2019 found that a high level of awareness of climate change risks was shown across the ADIs (Authorised Deposit-taking Institutions,

or what other people would call banks), general insurance and superannuation industries. All institutions in these industries were taking steps to improve their understanding of climate-related financial risks. General insurers are at the forefront in extreme weather events, drought, floods and associated events such as bushfires, and the extent of their losses from these events will influence future premiums and insurability. The 2019 floods in North Queensland have led to an upward review of insurance premiums. The Anglican Diocese of North Queensland reported: "... we are facing increases in our property insurance premiums of over 500%. At present we pay \$124,000 for our public liability insurance and approximately \$501,000 per annum for insurance premiums, including two of our schools. Our property insurance is due to increase to \$2,650,000 on 1st November 2019."

The Reserve Bank of Australia

The Reserve Bank of Australia states: "Climate change is exposing financial institutions and the financial system more broadly to risks that will rise over time, if not addressed."

Risks such as rising sea levels and an increase in the frequency and intensity of extreme weather (including storms, heatwaves and droughts) will create both financial and macroeconomic risks (RBA, 2019). The Reserve Bank suggests climate change be treated as "a trend in contrast to droughts which have been thought of as cyclical events." In addition, it has to be considered that climate events are more frequent, more severe and more long-lived. What is critical is the process of adaption of the economy to climate change; an abrupt transition creates more economic difficulties than a gradual" and "We need to think in terms of trend rather than cycles in the weather. Droughts have generally been regarded (at least economically) as cyclical events that recur every so often. In contrast, climate change is a *trend* change. The impact of a trend is ongoing, whereas a cycle is temporary."

Financial Developments and the Rangelands

Consideration of climate change cannot be local; climate change itself is global and a successful challenge to climate change must be global. The convergence of approach to climate change by international financial organisations and national regulators is significant as it indicates possible future developments. The major developments are that:

1. Insurers will scrutinise their exposure to areas affected by severe weather events; in extreme cases some assets and activities may become uninsurable.
2. Banks will become increasingly reluctant to lend on projects which are influenced by climate change.
3. Existing lenders may look more favourably on activities promoting climate change.
4. Innovations in the capital market may lead to greater funding for projects assisting in the transition to a carbon-neutral economy.

The economic costs of the North Queensland floods in 2019 shed some light on the possibilities of the future. Heavy rain in North Queensland, which set many records, caused severe flooding resulting in extensive damage to infrastructure and station property. Total stock losses are estimated at 664,000, including 48,000 sheep with a value of \$800 million. In addition, it was estimated, by the industry body AgForce, that more than 10,000 kilometres of fences were swept away, 15,500 kilometres of private roads were damaged, as were 1000 kilometres of water pipelines and 778 watering troughs (Major, 2019). Confirmation of these damages was provided by the Australian Agricultural Company's 2019 annual report (AACo, 2019). AACo, a publicly listed corporation, operates four stations in North Queensland and assessed the flood event as the "worst on record". Of the 82,000 cattle held on the stations, 43,000 were lost at a value of \$45.6 million.

Conclusion

Several aspects of the demand for beef have been examined, and it is clear that domestic beef consumption is on a secular downwards trend. The export market remains strong, but there are community concerns about animal welfare. As all enterprises in Australia operate with a social licence, the behaviour of the enterprises has to accord with community expectations.

Much of the discussion of the rangelands deals with short-term effects such as floods and drought, which have substantial economic costs. However, the longer-term issue of climate change is relatively ignored. As much as denialism is the fashion, events globally are treating the attempts to deal with the effects of climate change seriously. Despite the inactivity of politicians in Australia, the financial sector is developing a unified and consistent approach to dealing with important issues. Economic activity in the rangelands is exposed to heightened risks of being denied insurance cover and access to finance.

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Author Profile

Jon Stanford is a retired academic economist who is interested in the economics of climate change.

Policy Follows Population: Alternative Development for the Rangelands

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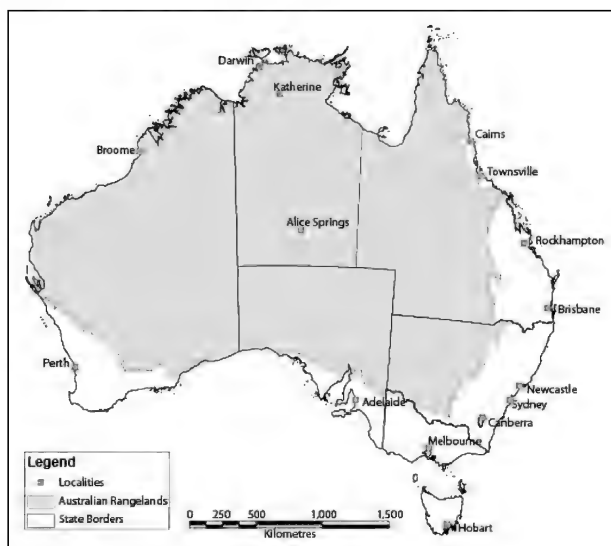
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Keywords: rural development, repopulation, wellbeing, policy

Australian Rangelands

Rangelands cover about 80% of Australia. This vast and remote heartland is commonly called the Outback (Figure 1). It has diverse climates (monsoon, arid and semi-arid) and ecosystems (savanna, woodlands, shrublands and grasslands). The most productive of Australian agricultural land is a small crescent along the south-east and south-west coastlines. With poor soils and unreliable rainfall, the rangelands are mainly used for grazing (Grundy et al., 2016).

Figure 1. Australian rangelands.



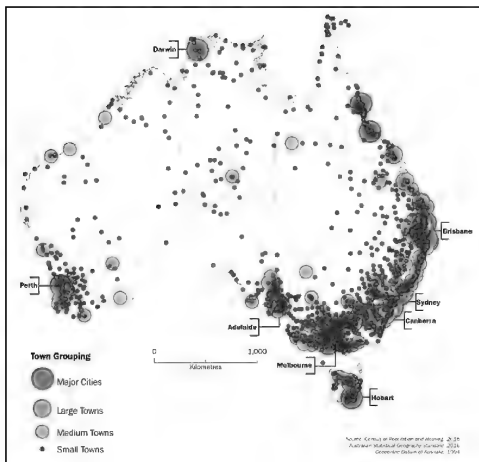
Source: CCIA (2019). <https://www.environment.gov.au/land/rangelands>

The average population density in Australia is 3.1 people per km², but the population is not evenly distributed (ABS, 2016a). Most people live in the productive zone: 71% of Australians live in large, mainly coastal cities, but only 10% of the population live in towns with fewer

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than 10,000 residents (Figure 2). The remaining population is sparsely distributed across the vast, remote rangelands. Indigenous people comprise 3.3% of the population and have a similar distribution pattern, with only 7% living in remote locations (ABS, 2016b).

Figure 2. Population distribution: major cities, large, medium and small towns.



Source: ABS (2016a). <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0~2016~Main%20Features~Small%20Towns~113>

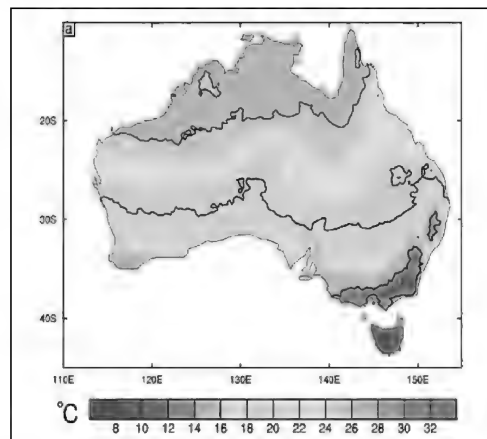
Changing Social, Physical and Economic Landscape

Between 2006 and 2016, the Australian population grew by four million, but the population of rural areas declined, and the agricultural workforce shrank more than 5% (Jackson et al., 2018; ABS, 2016c). Most rural residents are older couples with no children (47% rural, cf. 38% all Australia). Remoteness limits access to employment opportunities and quality incomes. The rural workforce is older (median 49 years, cf. 40). Unemployment is much higher, in part due to a less skilled agricultural workforce (55% have no post-school qualification, cf. 33% all Australia). Most agricultural workers are low-paid labourers, and rural incomes are 60% lower than all Australia. Rural Australians have poorer health than other Australians, in part due to

reduced access to services (AIHW, 2019). This shrinking, ageing, less skilled, less healthy and poorer population is significant when considering the future of the rangelands.

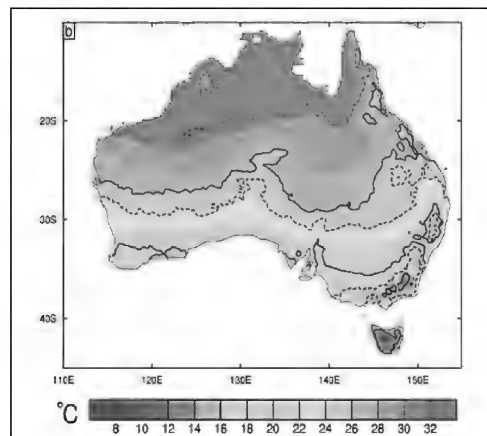
CSIRO maps demonstrate how the physical landscape is changing to a rapidly warming climate (Figures 3 and 4). The change from current to projected mean temperatures means existing agricultural practices are unlikely to be sustainable. This changing climate has serious consequences for the pastoral future in the rangelands.

Figure 3. Annual current mean temperature.



Source: CSIRO (2015).

Figure 4. Projected mean temperatures, late 21st century.



Source: CSIRO (2015).

The rangelands' contribution to the Australian economy is diminishing. Grazing on natural vegetation is the most common land use (44.9%), but the export value of all rural products has declined significantly over time (Table 1; DFAT, 2014). This reduction in the relative value of agriculture suggests that diversification would improve the economic sustainability of the rangelands.

Table 1. Australian export value by sector (%).

	Rural	Mining/fuels	Manufacturing	Other goods	Services
1969–1970	42.4	16.9	19.6	51.0	16.0
1991–1992	21.1	25.9	21.4	10.3	21.2
2013–2014	12.0	50.1	12.7	7.9	17.4

Source: DFAT (2014).

Wellbeing in Rural Australia

Rural people embrace an independent lifestyle: they are resilient, have a strong sense of place, and they volunteer more often than urban populations (Cheers, 2018). Yet the overall wellbeing of rural people is less than urban populations (AIHW, 2019). Rural Australians have limited access to professional expertise and skilled services of all kinds, including police, dentists, lawyers, counselling, health specialists and most trades. There are few support services for children, the aged, people with disability or for mental health. Skilled people are also less available in remote rangelands. As a consequence, people living in remote areas have higher mortality and morbidity rates, higher levels of accidents, suicide, depression and domestic violence. Beyond health, personal security and social care, remoteness reduces access to education and the creative arts. The constrained access to the Internet, mobile phones and services of all kinds in remote areas reduces access to information, emerging concepts and new ideas (Green, 2015). Access to ICT, education and the arts improves human capital, increases wellbeing in regional and remote areas, and offers a foundation to underpin successful innovation and development (Gibson et al., 2010).

Changing Policy Landscape

At the same time as life in the rangelands has become more difficult, there has been a persistent decline in public focus, and commitment

to provide support for remote areas of Australia has waned (Collits, 2001). For decades, Australian governments have embraced neo-liberalism, with 'small' government, self-help and self-management becoming a panacea for rural decline. Issues previously understood to be government responsibilities are now regarded as the responsibility of individuals, self-governing producers or community groups (Cheshire, 2006). Concurrently, rapid urbanisation has refocused policy towards providing urban infrastructure rather than supporting remote areas.

The rangelands are no longer embedded in the hearts and minds of the nation (Walker, 2015). In the era of globalisation and the new neo-liberal environment, remoteness has resulted in reduced political visibility and influence. Jacoby & Schneider (2001) demonstrate the influence of organised interest and lobby groups on public policy priorities. The National Party strongly influenced Australian government policy for many years, but its influence, along with other Australian rural business lobby groups, has weakened. As rural populations and the contribution of agriculture to export income declined, the National Party moved its focus to support economic growth through mining. Associated with this political change has been the decline in traditional news media and the rise of social media. The effects have been especially prevalent in remote areas of Australia, where remoteness and digital disadvantage contribute to social exclusion (Park, 2017).

Approaches to Regional Development

Taken together, these significant changes in the Australian social, political, economic and environmental landscapes suggest a need to rethink the future of the rangelands. What could be a realistic, socially and ecologically sustainable future? And what principles could guide a redevelopment process?

Traditional development approaches adopt a deficit model. Embracing the normative Chicago School economic stance, the central components are capitalism, competition and industrial growth. This version of development involves “self-help guided by a raft of community and business leaders focusing on creating innovative, creative, scientifically literate, highly networked, investment ready and risk accepting cultures [and it] requires an effective flow of venture capital and mutual support systems” (Sorensen, 2015, p. 41). These local requirements are not likely to occur in the Australian rangelands, and the level of policy commitment assumed to be necessary cannot be expected in the current Australian political environment focused on low taxes and small government.

Gray (2007) suggests a new form of regionalism. Emphasising a combination of participation and informed global engagement, he proposes an “eco-utopian” approach combining ecological modernisation with bioregional principles. Political decision making in new regionalism is democratic, participatory and collaborative. Communities are organised primarily around naturally defined regions. New regionalism is outward looking and globally engaged, with an ethos embedded in the notion of a global civil society to provide a vision and desirable level of accountability. In this utopian visualisation, production and consumption is local and cooperative, and natural resources are used efficiently. While this is a noble vision, it fails to consider how civic actions could connect effectively in the remoteness of the Australian rangelands landscape.

Others propose an entrepreneurial approach to transform localities, involving leadership and

knowledge-based cultural economies (Petrov & Cavin, 2013). This approach might suit urban environments where connections among participants can be made readily. However, it would need significant investment in human and social capital, as well as regional governance processes, to engender viable, long term improvement in wellbeing in remote Australia. Whether Australian governments would invest to embed effective changes is a decision that would need to occur at the ballot box.

Gibson-Graham (in Pike et al., 2011) notes that contemporary regional development has focused on rational economics, while cultures, networks and diverse practices have been devalued or ignored. In contrast, post-development theory does not assume a singular pathway towards improved wellbeing. Instead, it seeks to build a cooperative and empowering culture as a solidarity economy. By valuing diversity and rethinking the importance of social connections in an economy, “it becomes possible to imagine many different development pathways that build on local assets, experience and expectations” (p. 228). This holistic ‘bottom up’ regional development approach, incorporating community entrepreneurship, has been effective in Scotland, Quebec and Spain (Smith, 2012).

Indigenous development approaches are also highly relevant to the future of remote Australia (Lee & Eversole, 2019). Indigenous involvement enables access to important traditional cultural knowledge to design sustainable ecosystem management practices. Sharing knowledge and embracing Indigenous perspectives of relationships could generate cross-cultural innovation. Lee & Eversole argue this approach improves governance arrangements and service relevance, and advances wellbeing.

Incremental or Transformative Change Processes?

Accepting that the serious issues in rangelands need to be addressed, there is a question whether incremental or disruptive change processes should

be adopted. Governments frequently prefer an incremental change approach that considers cost benefits, evaluative frameworks and so on. Incremental change also allows projects to be timed for best effect at the ballot box. While noting that mining has produced the most significant changes in Australian rangeland landscapes, the Productivity Commission promotes a cautious approach:

Before investing in new infrastructure, governments should carefully consider alternatives to improve the use of existing infrastructure, particularly where incremental improvements or technology enables lowercost solutions, such as global positioning systems to manage demand and better utilise existing capacity (Productivity Commission, 2017, p. 74).

Rather than restraint, Walker (2015) advocates disruptive activism to capture policy interest. As an insider based in central Australia, Walker's advice is firmly fixed on the politics of remote regions. Even though the rangeland population is larger than the ACT, it is dispersed over 80% of the continent. This physical remoteness reduces public attention and political influence, especially in the current political environment. Walker argues that innovative radicalisation would progressively reignite the national interest required to achieve national investment. This viewpoint has some merit, even though it might appear to challenge the traditional conservatism of rural Australia. It will be essential to capture political attention to gain traction for the extent of change required to create a sustainable environment. Walker proposes that visionary policy initiatives would not only benefit the rangelands, but also the nation. His advice to be courageous and innovate beyond existing arrangements is commendable.

Alternative Future for the Rangelands

To survive as a viable region, two primary goals should guide rangelands development decisions: repopulation strategies and improving wellbeing. Expanding the population will

improve the visibility of rural and remote issues in the political landscape and gain commitment to the region. Creating long term, well-renumerated jobs will provide income for individuals and essential revenue for regional governance processes. Access to quality ICT and education services is vital to produce good jobs. Access to basics such as fresh food, along with support services for families, is essential to sustain the wellbeing of remote Australian populations.

Successful regional development strategies rely on a rigorous process to plan and coordinate the implementation process. Creating and maintaining an effective governance system will be vital if this vast region is to move beyond ameliorating regional adversity and achieve successful transformative change. Designing and implementing an effective governance system for the vast, remote rangelands region would be a complex task. Others have considered this issue (Foran et al., 2019), but fully discussing the governance process is beyond the scope of this paper. Instead, some underpinning principles that would inform decision making are proposed below. The most important principles are that decisions should be strategic, increase the population, create value, and improve human wellbeing by identifying:

- projects, events or activities that have the potential to increase physical, economic, social, cultural and information infrastructure;
- existing resources, e.g. space, sun, expert knowledge;
- regional strengths, e.g. resilience, commitment, creativity;
- opportunities that would contribute to long term income-producing capacity;
- opportunities with the potential to attract investors, including governments;
- opportunities that have the potential to create quality, long term jobs; and
- projects that are relevant to the region and that will generate benefits for Australia.

Four industries appear to have the potential to provide significant benefits for the rangelands beyond the existing grazing industry. The first two development options listed below could be achieved with internal rangelands governance. The other two options would require significant government involvement, but could generate enormous benefit to the rangelands if established.

1. *Alternative energy* is an obvious industry to extend benefits across the rangelands, since Australia has a huge coastline and the highest average solar radiation per square metre of any continent. Domestic uptake of solar energy has grown rapidly since 2010, especially among middle class households. Developing alternative energy projects and linking these to the south-eastern energy distribution grid would produce quality jobs and generate income in the rangelands.
2. *Strategic tourism development* to attract particular market segments. These will require systematic planning and coordination across the region to facilitate tourist movement between events in nearby locations. Traditionally, the Australian tourism industry has operated reasonably successfully as local small enterprises, but there has been little success in organising significant coordination to drive and sustain tourism destinations with major international appeal. Strategic developments of major new facilities would attract local and international markets, for example an Indigenous Cultural Museum.

Alternatively, strategic tourism could be designed around large, sequential *participatory* events occurring throughout the cooler months in remote areas. Investing in strategic regional planning and tourism coordination would improve the capacity to attract large crowds for annual events. For example, music events, racing and ballooning have been successful in remote

areas, and they are especially valuable for places with low populations. These kinds of activities could be extended to other events and activities, such as outdoor dining promoted as the 'largest table' in Outback Australia. A major Indigenous cultural centre would be a very significant attraction for international tourists, provided quality accommodation and travel services were available. Likewise, dinosaur tourism is a growing market. Investment in strategically expanding facilities aligned with major events might encourage longer stays and increase the spend of the large Grey Nomad tourism market. These kinds of activities would provide substantial income and seasonal employment for inland regions.

3. *An inland space centre* offers numerous benefits for the rangelands. In 1997, the Australian Government announced that a Space Agency would be created, predicting it could create thousands of jobs. Now established, it has a very modest staff in Adelaide. If located in the rangelands however, a space centre could bring international recognition for the region, generate inward investment, foster international collaborations and provide local income. Importantly, a space centre would build regional capacity by bringing human capital and quality jobs into the region. While there are few rigorous studies analysing the benefits of a space centre, it would appear to be highly likely to aid sustainable economic development and improve wellbeing in a way that would be culturally suitable for the rangelands.
4. *An Outback University* would bring students to the rangelands – an important consideration since some of these qualified students would stay in the region after experiencing rural life. Education already provides significant export income, but most Australian universities are located

along the Australian coastline. The Outback University could be established with multiple campuses, probably in Longreach, Alice Springs and Broome, possibly as additional campus sites of Charles Darwin University. The Outback University would provide an opportunity to co-locate facilities such as a hospital, school, TAFE training centre, library, sports training facility and specialist services. Co-located facilities bring benefits to isolated locations by enabling interactions between the academic staff and regional population (Charles, 2016). Providing different levels and kinds of education on the same campus would overcome the types of issues associated with the closure of the Central Queensland Training Colleges at Longreach and Emerald (Coaldrake, 2018). Provided the education facility offers a range of suitable

programs and operates effectively, studying at an Outback University has the potential to be highly popular with international students. These students would generate valuable export income and add to population diversity in the rangelands. Universities in similar remote locations, such as the University of the Arctic in Canada, provide valuable, quality jobs, and offer sites for regionally relevant research. Existing remote multiple-campus universities have been very successful. For example, the University of Alaska Fairbanks offers degrees to nearly 10,000 students, and it makes a significant contribution to the Alaskan economy. Likewise, the University of Tromsø (Norway) has 16,000 students and 3441 staff, including 1700 academics. Both of these universities conduct highly regarded and locally relevant research.

Conclusion

Opportunities for a prosperous future in the rangelands are constrained by changing social, economic and political landscapes. These issues, when combined with limited access to quality ICT, health, education and support services, have resulted in depopulation across the region. As the Australian urban population has proportionally increased, public commitment to assist remote Australia has declined. Public policy has followed the people, and Australian governments no longer feel committed to sustaining remote areas. It is vital therefore, to develop strategies to bring back people to the rangelands.

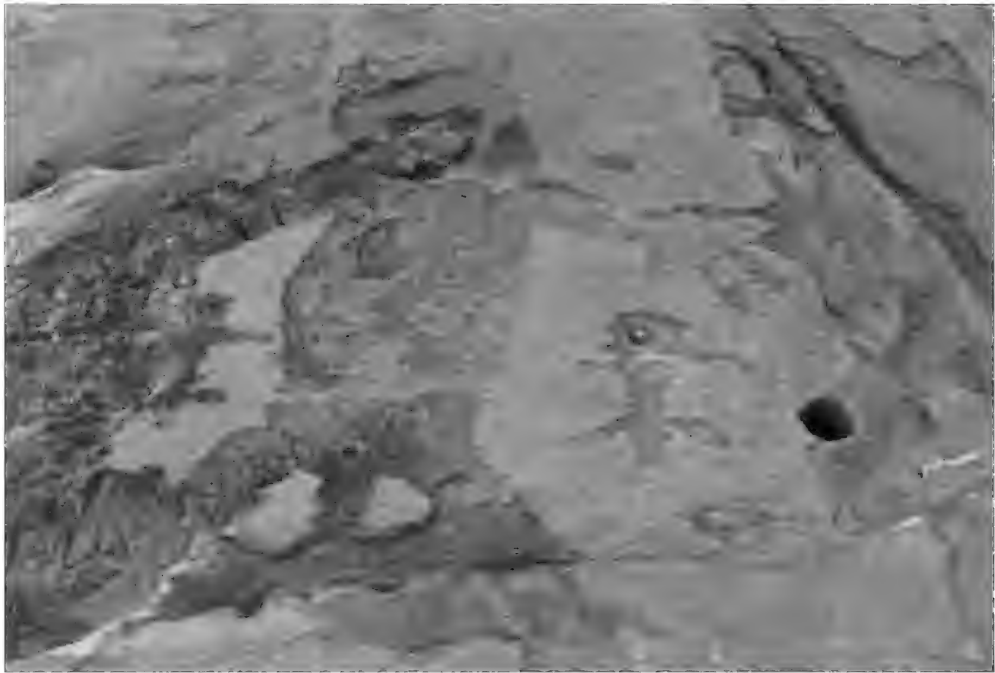
To achieve this goal of improved human wellbeing in the rangelands, it is essential to abandon an incremental change process, and diversify the economy beyond traditional grazing. The foremost principles guiding the selection of new industries should be to repopulate the region and improve human wellbeing. Four industries appear to have the potential to achieve these goals. Developing major strategic tourism facilities and events, along with an alternative energy industry, could be achieved with internal rangeland governance. Two larger projects could offer significant benefits for the rangelands: an inland space centre and an Outback University. These two major projects would require significant government commitment, but they have the potential to generate enormous benefit to the rangelands.

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An Indigenous Cultural Centre would be a strategic tourism attraction (Photo: Margaret House [Aboriginal Initiation Site in the Desert Uplands]).

Author Profile

Dr Douglas is an accomplished social researcher, business academic and development specialist, and has extensive experience as a health and community support professional. Her research is focused on change processes, social innovation and small, hybrid organisations. She has worked in the ACT and eastern Australia mainland states, and at the World Health Organisation in Geneva.

Climate Change Adaptation, Risk Management and Education to Meet Needs in Rangelands

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Keywords: climate change, risk management, best management practice, education, extension, adaptation



A robust stand of perennial native pastures with thriving cattle (Photo: W. D. Mills).

The development of applied climate knowledge and skills through education and extension programs is fundamental to our current livelihoods and future development in sustainable primary industries and rangelands, and is a proven, effective way for individuals, businesses and communities to address and overcome environmental challenges and enhance adaptive capacity (UNESCO, 2019a,b; AGO, 2006).

Despite our depth of knowledge of the ecology and autecology of Queensland's rangelands and their components (Burrows et al., 1988; Pressland, 1984), management of climate risk and its effects is difficult because of the high levels of climate variability that have contributed to past economic hardship and damage to environmental resources (Ash et al., 2012; AGO,

2006; Johnston et al., 2000; Marshall et al., 2011; McKeon et al., 2004). Although we can well learn from the benchmarks set by history, climate change is a new and evolving challenge that is placing increasing downward pressure on the productivity of landscapes, long-term livestock carrying capacities and the social and economic fabric of the rangelands (McKeon et al., 2009). This new challenge for managing climate risk needs to be addressed by further developing the knowledge and skills of those in rangeland communities to identify and improve adaptive capacity, and derive and apply best management practices (Clewett, 2012; George et al., 2019).

The evolving science of climate change is well developed and understood. This has allowed scientists to make definitive statements

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supported by scientific evidence. Their three pre-eminent claims are:

- Warming trends are supported by datasets locally, nationally and internationally. This is not part of a short-term cycle, but a trend that will prevail for the foreseeable future (IPCC, 2013; IPCC, 2014a,b).
- The trending increase in temperature is caused by increasing greenhouse gas (GHG) [carbon dioxide, methane, nitrous oxide, ozone, water vapor] concentrations in the atmosphere during the past 150 years (IPCC, 2013).
- Climate change and global warming are inexorably linked with global changes in rainfall, the health of ecosystems, agricultural productivity and the food chain, including in the rangelands of Australia (Clough et al., 2011). In Australia, that warming is demonstrated by the average mean temperature between 2011 and 2018 being the highest on record since recording began in 1910, at 0.77°C above the average (BoM, 2018).

The best graziers manage seasonal climate variability reasonably well and apply best management practices to minimise risks in sustaining production (AgForce, 2019). Those same graziers are generally aware of climate change. However, there is strong evidence (Michaels & Crossley, 2012), that agricultural communities require further development of skills to enhance risk, adaptive capacity and apply best management practices to avert the threats associated with climate change (Clewett, 2012). This includes skills that properly integrate financial costs, risk management, expectations concerning reliability of production, and the impacts on vulnerable natural resources (McKeon et al., 2004; Lloyd & George, 2008; George et al., 2016; Lloyd & George, 2016; Selby, 2007). Increased emphasis on education processes is a priority for better drought management (Wade & Burke, 2019), because it improves adaptive capacity of individuals and organisations

(AGO, 2006; George et al., 2007a,b). Mitigating against and adapting to the complexity of climate change in primary industries will require best production-management skills, new climate change management skills, and informed decision making (Smith & Oleson, 2010; FAO, 2013). An effective response to climate change is beyond the scope of many landholders because management options are constrained by the pressing need to manage for immediate circumstances. Therefore, the need for industry leadership, direction and support is paramount (George et al., 2019).

Climate variability already creates a major challenge for agriculture in Australia, and climate change ratchets up even more risky extremes (McKeon et al., 2004). Because climate change is all-encompassing along the food chain (an example of the “threat multiplier of climate change”) (Goodman, 2019), there is a need to strengthen strategic planning, risk management, and education and extension, at both the farm and national level (IPCC 2014a,b; Wade & Burke, 2019). There must be authentic, collaborative consultation processes and simultaneous strategies developed to establish ways forward that include ongoing development of best management practices (George et al., 2019) by farm managers, agricultural businesses and organisations, financial businesses, scientists, consultants and governments working together. Adaptation to and mitigation against climate change is essential and not optional.

An endorsed method for knowledge building to better manage climate and enhance adaptive capacity (George et al., 2007a) is the ClimEd accredited climate education process (George et al., 2007b), which involves building individual and industry competencies in:

- surveying climate and enterprise data (including natural resources);
- analysing climate risk and opportunities; and
- developing climate risk management strategies.

ClimEd is a unit of competency in the Australian Government Training Package and is referenced as “AHCAGB501 – Develop climate risk management strategies”. It has been widely used by educational institutions throughout Australia over the last two decades in many diploma and certificate level courses in agriculture, natural resource management and agri-business (George et al., 2016).

Further developing resources to support ClimEd (and so further building adaptive capacity), as a self-paced online course with interactive participation and greater emphasis on climate change science developments, risk management, deriving best management practices and proactive marketing to engage rural communities would add value to the existing package. It would provide an immediate and long-term vehicle to assist the implementation of recommendations in the Drought Program Review (Queensland) Report by Wade and Burke (2019). Continuing to build more resilient rangelands

with increased adaptive capacity via accredited competencies in management of climate risk is an important goal.

Governments, in concert with industry, should be urged to act as the catalysts to implement new recommendations to avert the effects of climate change on agricultural and pastoral production systems and the environment (COAG, 2018). Alongside the specific recommendations made in the Drought Program Review (Queensland) Report (Wade & Burke, 2019), the implementation would be best facilitated through collaborative, autonomous processes involving all stakeholders – as described above – in designated agro-ecological regions (George et al., 2019). This will require urgent and continuing investment in education and extension programs as standard components to building adaptive capacity. Business as usual, ‘no action’ or maladaptation is contrary to the best interests of Australian agriculture and natural resources (Garnaut, 2008, 2011).

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Author Profiles

David Lloyd was responsible for managing the QDPI component of pasture plant improvement and development for pasture/crop systems in sub-tropical southern inland Queensland; including the release of 24 new legume and grass cultivars, and the 'LeyGrain' pasture education program.

Dr David George has developed, delivered and evaluated applied climate courses in the primary industries sector. He established national accreditation of *Developing climate risk management strategies* into the Australian Qualifications Framework.

Dr Jeff Clewett is a research scientist seeking to improve management of climate risk. He has developed several tools to analyse climate data and assess the influence of climate (variability and change) on crop and grazing systems, and has greatly valued many interactions with producers and business people while contributing to climate education and training throughout Australia.



Soils For Life Synopsis

Major General The Honourable Michael Jeffery AC, AO(Mil), CVO, MC(R'td)
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*We have major problems with land and water degradation.
We also have sustainable solutions with better returns socially and economically.*

The Global Problem

It is becoming increasingly obvious that many areas of the agricultural world are facing substantial soil, water and food sustainability problems. This is particularly so in India, Pakistan, China, sub-Sahara Africa, the Middle East and even California. There are serious water and arable land availability issues in the countries mentioned, along with severe pollution of many major rivers, particularly in China.

At risk is the planet's capacity to support the availability of adequate food and water for a future global population of 10 billion by 2050, up from the present 7 billion.

The social implications of a lack of food and water globally will inevitably impact economic growth, with soil and water security increasingly underpinning global social stability and security. The status of the world's soil and water has such great impacts on social stability that some nations now include natural resource availability in their military threat assessment process.

The President of the World Bank, the UN Secretary General and various world leaders have drawn attention to this problem, stating that sustainable global food and water is a major

issue and that: "Fights over water and food are going to be the most significant direct impacts of climate change in the next five to ten years" (Jim Yong Kim, President of The World Bank).

National Soil and Water Issues

Whilst Australia has land and water degradation problems, we also have the solutions. It is my intention as both the National Soil Advocate and Chairman of Soils For Life (SFL) to demonstrate those solutions both for a national and global benefit. These solutions involve regenerating degraded landscapes, ensuring more resilience in the face of increasing climate variability, and the provision of clean, green food and fibre on a sustainable basis. This increases the 'natural capital' value of the landscape and assists landholders to gain better returns socially and economically.

Suggested Remedial Strategies

We are approaching the problem through a three-part strategy to:

- (a) define the global imperative and the national opportunity this creates;
- (b) fix the paddock; and
- (c) fix the policy.

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Global Imperative/National Opportunity

The first component of the strategy involves Future Directions International (FDI), a Perth-based, independent, not-for-profit strategic research institute with Deductible Gift Recipient status. I established it in 2001 to conduct comprehensive research of important medium- to long-term issues facing Australia. It is linked to Soils For Life (SFL) to determine the extent of a possible global food and water crisis and what Australia might do to reduce it. FDI is producing an annual report for the Prime Minister and other national leaders to keep them informed on this critical issue and as a conduit for Australia to lead the way in demonstrating proven agricultural landscape regeneration solutions.

Further information can be found on FDI's website: <http://www.futuredirections.org.au>

Fixing the Paddock

In 'fixing the paddock' we have established 26 SFL case studies of leading agricultural best practice across a range of agricultural enterprises and established a proven farmer-to-farmer mentoring program. After successful testing of this program, Soils For Life is now rolling out the next phase of 100 case studies over three years to embrace all agricultural types and geographic locations in Australia.

This SFL program is to become a long-term data/information/research base for leading practice soil/water/agricultural matters, using successful volunteer farmers as the test base. The primary areas of evaluation include soil carbon and nitrogen levels, water retention in the soil capacity, food and nutrition levels, innovation and triple bottom-line performance measurements (social, economic and environmental), as part of a new, comprehensive natural capital assessment.

Of particular importance will be finding the means to measure soil carbon levels as this is a vital component of, and a key indicator of, a healthy soil. Soil carbon helps support a healthy balance of nutrients, minerals and soil microbial and fungal ecologies, and enhances the ability of the soil to hold water. Across the Australian dry

land cropping and grazing sector, most actively farmed soils have a carbon content of 1.5% or less, yet to deliver its myriad of benefits, the soil carbon levels for quality agriculture should be around 3% to 5%.

SFL is an active partner and participant in the recently formed Cooperative Research Centre for High Performance Soils (CRC-HPS). The SFL case studies will provide quality research sites for the CRC's four program areas.

Further information on Soils For Life and the initial Case Study reports can be found on the website at: www.soilsforlife.org.au

Fixing the Policy

The third component of the strategy is to 'fix the policy'. This requires Federal/State/Territory political agreement to establish a national objective to "restore and maintain the health of the Australian agricultural landscape".

The key components to implementing the national objectives are:

1. To declare our soil, water and plants as *key national, natural strategic assets* to be managed as such and in an *integrated* way.
2. To reward our 85,000 farmer businesses adequately for both their product and as primary carers of 60% of the Australian landscape.
3. To reconnect urban Australia with its rural roots by establishing a school garden in every primary and junior high school in Australia, with a properly coordinated and mandated teaching program. By age 16, every Australian child will have a fundamental understanding and appreciation of the function of soil, water, plants and food production.
4. To do a stocktake of our soil/water science knowledge base, highlight key gaps, re-task our research accordingly, and improve our extension service delivery capacity nationwide.
5. To examine regulatory duplication and overburden.

Conclusion

I believe our three-pronged approach is a unique and comprehensive way to develop for the first time a national strategy – supported by proven farming techniques – to regenerate and maintain the health of the Australian agricultural landscape with positive national, regional and global benefits.

Author Profile

Major General The Honourable Michael Jeffery AC, AO(Mil), CVO, MC(Rtd) hails from Wiluna, Western Australia. His distinguished military career includes operational service in Malaya, Borneo, Papua New Guinea and Vietnam, where he was awarded the Military Cross and the South Vietnamese Cross of Gallantry. He served as Governor of Western Australia from 1993 to 2000 and as Australia's Governor General between 2003 and 2008. In October 2013, he was appointed as Australia's National Advocate for Soil Health. In that role, Michael has been pivotal in alerting Australians to the generally poor quality of our soils. His vision – to encourage all Australians to focus on soil health and the urgent need to regenerate our urban and rural landscapes – underpins the work of Soils For Life. Currently, he is Chairman of Future Directions International.



Rangelands Policy Dialogue Speech on Behalf of AgForce

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Keywords: consultation, environmental regulation, stakeholder respect

AgForce was pleased to co-host the Rangelands Policy Dialogue in July 2019 along with The Royal Society of Queensland and NRM Regions Queensland, on behalf of the broadacre agricultural industry.

The overall purpose of the meeting was to amplify the collective wisdom of those present through synthesis and debate. My “Spark Plug” contribution below, on behalf of industry and AgForce, was deliberately provocative but done so in the spirit of a frank and full dialogue with other people who care, in the hope of contributing meaningfully to an important conversation:

Introductory Remarks

Crafting a declaration for a sustainable rural future in the rangelands – markets, debt, water, drought and climate change – is a lofty ambition. It is also one that industry applauds, given that we have simply been unable to do so until now. How many teachers, nurses, bank branches, small businesses, graziers, etc., have been lost in rural and regional Australia as our landscapes, biodiversity, and social, cultural and economic fortunes have gone backwards ...? How long has Rome been burning? The other Friday night I arrived in Charleville at 8.00 pm, hungry and thirsty. All the kitchens had closed and I went to bed that night with nothing but a couple of beers in my stomach.

It is no news to anyone in this room that the

rangelands include those inland environments where natural ecological processes predominate and where values and benefits are based primarily on natural resources. The rangelands of the semi-arid and arid zones cover approximately 80% of the Australian continent. The rangelands are an incredible natural resource but are not given anything like the visibility that other beautiful and rich natural wonders like the Great Barrier Reef are afforded. I am not necessarily arguing that they are as special or unique as the Great Barrier Reef, but I am arguing that their value and significance are not broadly understood, despite the best efforts of groups such as the Outback Alliance and the Australian Rangelands Society.

Learnings from the Past

For several years now, policy settings in Queensland relating to the rangelands and other landscapes of Queensland have been completed without a genuine or full engagement with industry or many others who have powerful and relevant contributions to make, care about outcomes and want to contribute.

The vegetation management legislation of 2018 and the Reef Bill of 2019 are classic examples. I do not raise these to politicise the conversation, but actually to do quite the opposite: that is, to talk openly and honestly in the hope that this strong conversation among friends who care equally

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and so deeply for the right outcomes will result in a quantum shift in this state's approach to our landscapes.

The fact is that detailed, numerous and in many cases scientifically based submissions have been completely ignored. This must fundamentally change if we are to get our collective knowledge, wisdom and energy onto this critical issue of sustainable management before it is too late. My hope is that this dialogue may provide a circuit breaker and a new beginning. We approached this dialogue in that spirit and with that intent. Here are some statements in support of this view:

1. Setting policy in isolation from industry or others who have a valuable contribution to make will not allow us to make the progress we want to and need to make. A genuinely broader engagement is needed.
2. Politicising critical debates leads to worsening economic, social, cultural, biodiversity and environmental outcomes. Again, the vegetation management debacle of 2018 can be used to show this clearly. Many examples, such as in the Mulga Lands, show economies going backwards as people find that the best economic opportunity for their land is to lock it up and accept carbon credits. What then happens is that a family leaves town, the farm no longer contributes any economic activity to the region, pests and weeds start to invade the landscape, and the mulga thickens and in doing so worsens environmental outcomes – biodiversity suffers because of that thickening. Mulga has been managed for thousands of years. The Mulga Lands can be managed in an environmentally friendly way that allows those landscapes to contribute to local communities. I so look forward to the day when I have options and choice for a meal on a Friday night in Charleville – I believe it is possible but will require strong leadership such as is being displayed at this forum.
3. Industry has a powerful contribution to make collectively and individually but is continually locked out and prevented from doing so. For example, we made some strong submissions for projects within the Land Restoration Fund which were dismissed without reason, and then AgForce was offered an MoU for a small amount of money and has been offered no stronger role despite a strong desire, the ability and the energy to be a much stronger partner.
4. Northern Australia is on the brink of exciting new agricultural development and employment opportunities, including helping Indigenous communities prosper from growing crops and cattle. New agricultural developments already have enough checks and processes to ensure feasibility through existing state-wide planning and vegetation management Acts. There is no need for further restrictive and costly Reef-centric regulations for farm design.
5. We can learn something from the first people of this great country of ours – Indigenous Australians. Rather than mass clearing land in football field-sized blocks, as is often misreported in the media, farmers are managing thickening vegetation on their properties to restore the land, much in the same way Indigenous Australians have been managing the land for more than 60,000 years: maintaining a balance between trees and grass with more open landscapes, encouraging healthy regrowth and a balance between the different types of vegetation that are more representative of pre-settlement times. Farmers know that where management of the land is taken away from the people who understand it the most, feral pests and plants thrive, increasing the risks of wildfire with greater fuel loads.
5. We live in a state of 13 unique bioregions. It is an incredibly beautiful and unique part of the world. Recognising that is a

critical underpinning to making genuine progress and is largely missing to date.

6. It is essential that we support those eager to push boundaries and make strong progress, as well as legislating to bring along their tail or encourage them to pursue other vocations. I will only fleetingly mention the Best Management Practice fiasco today – but what an incredible opportunity was lost when the government requested data held by AgForce on behalf of participating farmers. We must work diligently to support best practice and push boundaries at least as strongly as we work on legislating minimum standards for environmental performance.
7. Don't underestimate the interest, intellect and desire of graziers, farmers and industry in rolling up our sleeves and getting stuck into this. It is a resource that has not been well used to date. The majority of graziers, those who work the land every single day, are trying to do the right thing and improve the landscape, to leave it in a better condition for future generations than the way they found it. But working out what the right thing is isn't always easy. There exists a complex relationship between federal, state and local government legislation that needs simplifying in order to deliver clearer, more accurate advice to landholders about managing vegetation and their land. Legislation related to how landholders should manage woody vegetation has changed 40 times over the past 20 years. We also have the situation in some locations where areas of land are considered exempt and therefore available to be managed and used for grazing under State Government vegetation management legislation, but certain local councils now require landholders to secure their approval before they clear any trees; and then, as recently as two weeks ago, along came new 'blue dot' trigger mapping

that seeks to override everything else and leave landholders in a situation where they can't manage their land at all.

Agriculture has the environmental credentials to make a difference. If I return to my earlier example of the Great Barrier Reef, the agricultural sector has led the way by enacting measures that significantly reduce the risk to the Reef through the adoption of sustainable and efficient farming practices, while at the same time increasing food production. Agriculture has also done more than any other industry – including urban utilities like sewage treatment and power generation – to reduce runoff and greenhouse emissions. The goal for agriculture is to reach carbon neutrality by 2030, and as an industry we are well on the path to achieving this. Agriculture is contributing more than 80% of the total emission reduction contracted under the Australian Government's Emission Reduction Fund (ERF) auctions. Were it not for our sector, Australia would have no chance of achieving its emission reduction targets at all.

Lessons for the Future

Can we genuinely take those lessons and apply them fully to strengthening our future trajectory? Can we step over our partisan political positions and out of our bubbles and fully embrace these and other learnings? If we cannot we are doomed to more of the same, and the consequences of that are difficult to contemplate. I offer the following points in support:

1. Industry can contribute so much more economically, socially and environmentally. We request that other sectors and the broader Queensland community give us that chance.
2. Landscapes need a long-term plan based on science and learnings – and baselined correctly. That will allow, for example, all parts of the community to move forward with confidence and surety. Sure, new learnings should be bought into the

- framework, but the fundamental framework needs to be set – with a correct baseline giving comfort around environmental and biodiversity aspects.
3. Policy settings currently are fundamentally wrong. This dialogue is necessary and important in correcting settings in a way that allows a strengthening of these critical environmental, biodiversity, social and economic trajectories whilst we still have a little time on our side.
 4. Bipartisanship is critical given the long-term nature of this undertaking: an incredibly lofty and difficult ambition, but one we must strive for if we are serious. We often talk about leaving the landscapes in a better position than we found them for the benefit of future generations – this is a critical underpinning to that objective.
 5. We have a bold ambition – otherwise we would not be here. No bold ambition (and particularly one that will be difficult to achieve) will survive without a strong vision and purpose that is set by and supported by the broader community.
 6. It is not too late for a bold and ambitious reset, and landholders and industry want to be at the table, doing their share of the lifting and learning and being a strong and central part of the solution.

Conclusion

In conclusion, I wish to make two points:

1. AgForce and industry have a resolve for continuing collaborative development of pilot projects in several bioregions to build on-ground understanding of alternatives to the current punitive approach to controlling management of regional ecosystems. Alternatives can be constructed to build natural capital and resilience of regional ecosystems through financial support of landholders and with conducive policy settings that reward them for good practice.
2. AgForce and industry applaud this dialogue initiative. We hope it is the start of something meaningful and big. We want to play our part and believe we have a lot to offer. Thank you to those of you who have helped in bringing this together.

Author Profile

Born and brought up in New Zealand, Michael has spent his personal and professional life involved with agriculture and regional and rural communities. In his current role as Chief Executive of Agforce Queensland Farmers Ltd, Michael works for and on behalf of broadacre producers across Queensland.

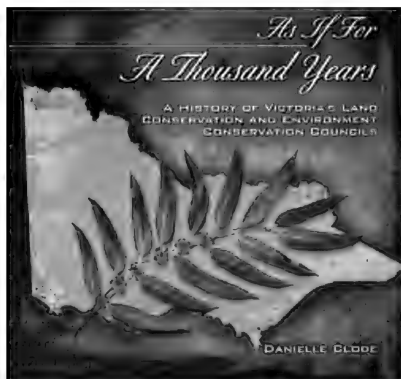
As If for 1000 Years: A Land-use Planning Authority for Queensland?

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Keywords: land-use planning, statutory authority



Relevance

This paper reports on Victorian experience in establishing a statutory authority to advise the government on the use of public land. As Queensland grapples with a number of unresolved dilemmas – whether irrigated cotton is an appropriate use of the Murray-Darling floodplain, mining versus agriculture and carbon sequestration versus tree clearing on pastoral land for example – the value of an independent authority of this kind should be a prominent topic during public debate over the future of the rangelands.

Analysis

“AS IF FOR A THOUSAND YEARS” was the planning horizon directed by the Minister when he commissioned the fledgling Land Conservation Council to assess all of the public land

in Victoria with a view to determining its *most appropriate use*.

That was 1970, at the dawn of an era when it was possible to conceive of a state government being persuaded by scientific advice and public pressure to pursue a pro-conservation agenda. The government of the day was a conservative government: the Minister, Bill Borthwick, was a Liberal in Henry Bolte’s Coalition.

Henry Bolte was a ‘capital C’ Conservative, but he was shrewd enough to heed a groundswell of public opinion opposed to the government’s decision to clear virgin heathland in the Little Desert in the north-western Wimmera region for pastoral production. He was nudged along by *The Age* newspaper, which had supported a pro-environment campaign on that particular issue for months. Further, it had not escaped the government’s attention that agricultural scientists,

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biologists and other experts within the public service had been quietly publishing reports and briefing community groups against the project – leaking, we would call it now – for years.

The Land Conservation Council faithfully followed the Minister's instructions. By 1988 it was able to report that 98% of its recommendations had been accepted by governments – of both major persuasions (LCC, 1988).

Upon the establishment of the Land Conservation Council in 1970, controversy drained out of many land-use dilemmas, development of the Little Desert not least. With the promise of a transparent assessment of scientific and socio-economic parameters, a transparent process of public consultation, overseen by a body regarded as independent of both the political parties and sectoral interests, all sectors set their minds to generating and submitting their own evidence and insights. The Wimmera region was deferred until late in the work program as many other resource-use controversies pressed themselves forward.

Comparability with Queensland's Pastoral Estate

The land tenure canvas of Queensland is very different from that of Victoria in the 1970s. The Land Conservation Council's remit was restricted to *public* land. This included a large number (thousands) of Crown reserves of a small total area, but the main focus of its work was the large tracts of Unallocated Crown Land and Reserved Forest under the administration of the Department of Crown Lands and Survey and the Forests Commission Victoria, respectively. There were fierce debates within the public service and in the public arena over high-country grazing and in particular logging.

Queensland has a very different tenure canvas. There is very little Unallocated State Land, mainly water frontages and residual discontinuities in the cadastre. Much of the coastal area that was previously forest reserve has been transferred to national park. The great bulk of the Crown estate – some 60% of Queensland –

is not *public* land but *private State* land leased for grazing, either in perpetuity or for a term of years, with few alternative economic uses. A work program for a comparable body in Queensland's rangelands (by no means the only potential assignment) would look quite different. First, it could examine the future use of term leases long before their expiry, to give certainty to the lessees. Second, it could examine the case for freeholding of perpetual leases and other changes in tenure status on a strategic basis rather than an ad hoc property-by-property basis as has traditionally been departmental practice. Third, it could replicate the pioneering assessment of land for its potential as national park by Sattler and Williams (1999), chronicled in Sattler (2017). Pre-eminently, it would examine the implications of climate change and environmental deterioration for continued pastoral occupation.

In parts of Queensland, the business model of family pastoral enterprises has run its course, as the converging challenges of climate change, the prevailing economic framework, the cost of restoring degraded lands, the inability to manage marginal lands sustainably, the inflated value of rural properties and the hollowing out of rural communities are coming to overwhelm the capacity of single families to cope.

Given the sovereignty that pastoral lessees enjoy over their lands, such a work program would need to be restricted to an advisory role, with the bulk of its work being mapping and regional assessment that would be of as much benefit to graziers as to local government and the state. It would be of immense service if it did no more than fill the gaps in resource assessment, such as those identified in 2004 by Sanders.

In the 1970s there was a Division of Land Utilisation within Queensland's Department of Primary Industries which produced excellent mapping of natural resources and the value of lands for primary production. Unfortunately, this original work did not receive the support needed, due to the rural politics of the day.

Budgetary Parsimony

Come 2019 in Queensland, one can now only dream of budgetary adequacy for the natural resource mapping and assessment necessary to underpin prudent decisions on regenerative agriculture, carbon storage, national parks and biodiversity, coal mining, gas drilling, transport infrastructure or any of a number of other land uses. The number of scientists employed in the state's public sector in both systematic and curiosity-led resource assessment has suffered from years of budget cuts, hostility from some governments and repeated restructuring. Funding is now more likely to be project based, requiring repeated justification.

Anecdotal evidence suggests that the capacity of the Department of Premier and Cabinet in particular to coordinate between portfolios has been severely weakened and that staff now spend their time responding to the day's dramas as selected by the Editor of *The Courier-Mail*, whose opinion as to what is and is not important is more influential than that of any scientist or policy officer in sight.

The lack of investment in forward planning for managing Queensland's resources and landscapes is not surprising, given that commentators like Andrew Bolt, Peta Credlin and Judith Sloan (2018) and editorialists year after year use their privileged position in the pages of *The Courier-Mail* and *The Australian* to denigrate scientists and cast doubt on scientific advice. Their antipathy is directed at environmental science and especially climate science: they don't pour scorn on the electronics engineers, chemists and physicists whose labours bring ever more wondrous technological inventions into our lives.

How far has public debate fallen since the 1970s in Victoria when a groundswell of public opinion and media commentary obliged the government of the day to establish the Land Conservation Council!

Gravestones

It is not just incremental budget cuts damaging individual agencies that have weakened

Queensland's ability to solve controversies in the use of its natural resources. Entire agencies have been abolished. Royal Society member David Marlow has compiled tables (Marlow, 2019) outlining a sample of scientific bodies that have been abolished despite faithfully achieving what they were commissioned to achieve and despite producing information of value to a broad range of business, government and civil society sectors.

The establishment of bodies such as the Resource Assessment Commission, Land & Water Australia and the National Land and Water Resources Audit is evidence that the need for partisan-independent expert bodies charged with gathering evidence from numerous disciplines and crossing sectoral silos to produce considered recommendations for decision makers is widely recognised. Those three were national bodies that were not replaced by any institutional architecture for independently evaluating competing claims upon natural resources or for monitoring condition and trend; the Queensland Government is constitutionally competent to establish its own.

Conclusion

In considering the adequacy of the institutions of government to resolve the challenges that accelerating climate change will place in front of landholders and policy makers alike, Queensland should look across the border to the Victorian experience which placed land-use decision making on a systematic, consultative basis informed by the best science that could be assembled at the time.

Bill Borthwick died in July 2001. On the day of his funeral, one of his senior officers delivered a lecture in Brisbane to Queensland public servants on the history of achievements of the Land Conservation Council in establishing a measured, scientific basis for land-use decisions. The proposal for a comparable body has yet to find a firm place on the policy agenda of either major political party in Queensland. In Victoria, Mr Borthwick's legacy will undoubtedly endure for as long as there is responsible government and orderly land administration, quite plausibly for a thousand years.

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Author Profile

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National Parks and Tourism in the Rangelands

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Keywords: national parks, protected areas, ecosystem services, biodiversity, wildlife, tourism, Queensland, rangelands

National parks (and to an increasing extent, non-government protected areas) make a vital contribution to the future economic growth of the rangelands. Areas of intact natural ecosystems protected inside parks and reserves contribute real economic value to human society, by conserving useful plants and animals (like wild macadamias, pest-eating birds and pollinating insects), by moderating climate extremes, and by providing clean water and clean air. These values are impaired by excessive human use, ecosystem degradation or conversion to developed land uses. Protected areas, by permanently re-orienting land management exclusively to the conservation of nature and maintenance of ecosystem services rather than production, represent the best option for conserving those valuable services. The terrestrial National Reserve System, consisting of national parks, private and Indigenous protected areas nationwide, conserves *non-tourism* ecosystem services worth at least \$37 billion a year to Australian society (Table 1; Taylor et al., 2014).

Wild nature tourism (also known as ecotourism) is also a natural ecosystem service, but one which is relatively easy to put a dollar value on. All wild nature tourists, whether international or domestic, overnight or day-trippers, spent \$23.6 billion in 2012–2013, a level of spending that has doubled since 1999–2000. Half of this

spending is accounted for by international wild nature tourists, which represents 60% of spending by *all* international visitors. The wild nature share of international visitor spending has been increasing steadily among Asian visitors as they become more familiar with wild Australia (Taylor et al., 2014). These estimates, using Tourism Research Australia statistics, cover spending on any and everything during visits to Australia, but also underestimate real spending because vehicle spending or packages and flights paid for overseas before arriving are excluded. Nature-based tourism has shown no signs of slowing growth, total spending nearly doubling from 2005 to 2016 (Tourism and Transport Forum, 2017).

An obvious question is: “Wouldn’t they have come and spent the money anyway, park or no park?” Ballantyne et al. (2008) set out to answer that question for visitors to Queensland national parks. They found that in the 2006–2007 period, visitors to national parks in Queensland spent \$4.43 billion on their trips. The tropical north of the state had the largest regional share, 30% of all visitor spending. At least \$749 million of all spending by parks visitors could be strongly attributed to the parks, meaning they would not have taken that holiday or spent that money if the parks were not available to visit (Table 2).

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Table 1. Estimates of the total values of ecosystem services secured in Australia's National Reserve System in 2012 (AUD billions) (Table 1 from Taylor et al., 2014).

Service	Example of what protected areas do	Marine		Terrestrial	
		Australia/ high-income countries minimum values	Global average	Australia/ high-income countries minimum values	Global average
07 Air quality	Protected forests near cities filter air pollutants			\$0.08	\$0.06
08 Climate moderation	Protected seagrass beds or forests soak up carbon	\$69.92	\$76.74	\$0.13	\$15.93
09 Disturbance regulation	Protected mangrove forests buffer storm or tsunami damage	\$94.24	\$109.84	\$0.16	\$12.05
10 Water flows	Protected forests soak up and slow down otherwise excessive runoff			\$2.34	\$23.79
11 Waste treatment	Protected wetlands filter pollutants from water flowing through	\$0.44	\$105.41	\$2.62	\$13.55
12 Erosion prevention	Protected riverside forests prevent soil erosion	\$961.77 ^a	\$3,313.25 ^a	\$1.50	\$11.94
13 Nutrient cycling	Protected semiarid forests prevent soil salinity	\$198.05 ^b	\$0.03	\$0.46	\$7.66
14 Pollination	Protected habitat near cropland harbours natural pollinators			\$5.71 ^b	\$1.80
15 Biocontrol	Protected habitat near cropland harbours insectivorous birds	\$5.43 ^b		\$0.94	\$6.14
16 Nursery habitat	Protection of key breeding habitat of fish species that are consumed	\$21.09	\$24.87	\$27.38	\$72.43
17 Genetic diversity	Protection of habitats of wild relatives of commercial crops	\$11.12	\$124.28	\$0.11	\$38.64
TOTAL		\$196.84	\$441.16	\$37.51	\$203.98

a) These estimates were so much higher than all other estimates, and based on just one study for Caribbean coral reefs. Accordingly they are considered unreliable and excluded from totals.

b) These values are substantially higher than those based on global averages and so are replaced in these cases by estimates using global average values.

Table 2. Estimated total spending by visitors to national parks in Queensland regions (Table 13 from Ballantyne et al., 2008). ‘NP-associated’ means all spending by parks visitors on their entire trip, whereas ‘NP-generated’ means spending that can be unambiguously attributed to the presence of the parks visited.

Region	National park tourist spending: simulation mean values by region			
	Best estimate scenario		Maximum estimate scenario	
	NP-associated	NP-generated	NP-associated	NP-generated
Gold Coast	\$676,618,526	\$82,392,662	\$873,698,262	\$106,391,301
Brisbane	\$680,620,213	\$82,879,952	\$1,114,798,965	\$135,750,428
Sunshine Coast	\$464,362,394	\$56,545,974	\$563,068,517	\$68,565,539
Mackay	\$94,071,809	\$19,351,915	\$124,044,083	\$25,517,640
Whitsundays	\$219,896,562	\$45,235,864	\$455,817,492	\$93,768,170
Capricorn	\$94,849,122	\$17,592,962	\$137,809,425	\$25,561,428
Carnarvon	\$23,410,598	\$4,342,288	\$26,789,573	\$4,968,034
TNQ	\$1,330,952,874	\$273,796,020	\$2,090,053,773	\$429,953,919
Outback	\$59,810,172	\$11,434,298	\$75,600,998	\$14,453,132
Townsville	\$209,005,953	\$38,767,233	\$354,356,790	\$65,671,824
Toowoomba	\$108,571,250	\$20,323,700	\$140,946,943	\$26,143,385
Wide Bay	\$181,614,974	\$37,360,795	\$267,080,562	\$54,942,287
Great Sandy	\$288,447,312	\$59,337,733	\$467,094,227	\$96,087,955
Total Queensland	\$4,433,231,758	\$749,361,416	\$6,690,859,608	\$1,147,776,038

National parks benefit tourism at multiple levels. First, they provide desirable destinations tourists can visit on their holidays (destination value). The national parks system is a fundamental asset of the tourism industry, as much as Sydney airport is, but one that is largely taken for granted – more of that below. Second, parks underpin the international image of Australia (or regions within Australia) as a wildlife or nature destination of global standing (attraction value). Visitors are attracted here using nature imagery that mostly comes from national parks. Even if they only visit Taronga Zoo, that wild nature image is what brought them here. Finally, by saving our unique wildlife from extinction, parks ensure that visitors can still get to see native animals which otherwise would already have disappeared (wildlife value). This works at both the destination and attraction levels.

There has been a lot of praise for, or complaints about, the ‘grey nomad’ tourism phenomenon:

praise for their keeping small regional towns alive with the money spent on fuel, groceries, meals, souvenirs and sometimes accommodation; and complaints because they tend to travel in caravans and RVs and so don’t spend much on accommodation, and try to camp free whenever they can. Whilst only about a third of all caravanning and camping travellers are 55 or over in age and their daily spending might not be huge, they make up for it by spending long periods on the road, spending as much as \$16,000 per annum on their trips, all of it sprinkled throughout regional Australia (Economic Development Committee of the Queensland Parliament, 2011). These figures are a decade old now, and are likely to be much greater as the Baby Boomers hit retirement age. Some parks on the grey nomad trail in Queensland, like Boodjamulla (Lawn Hill), attract 150 visitors a day in the peak dry season, mostly grey nomads (QPWS, 2013).

The point of all this is that without those

parks, there would have been few publicly accessible destinations to visit in regional Queensland, particularly when you consider that the dominant motivation for caravanning and camping travellers is to experience natural beauty and the bush. Without those parks, it is unlikely we would have seen quite the volume of grey nomads passing through and spending their superannuation in the regions that we do now.

New businesses have sprung up in areas where cattle used to be the only option. Undara Experience is one example. The Collins family saw the tourism potential of the strange lava tubes on their station back in the 1980s and pushed for the creation of Undara National Park. Their lodge and tour business at the edge of the park is now a prime tourist hotspot, which doesn't just benefit Undara Experience, but all the other small towns in the region that see visitors passing through and beyond, attracted by the natural beauty of Undara and the other national parks of the region.

Parks have grown substantially in Queensland (including the additions of Undara and Boodjamulla). But there has also been strong growth of private and Indigenous protected areas. Although these do not traditionally have the same 'tourism pull' of national parks, because they are not usually open to the public, there is now a growing number of nature refuges (the official type of private protected area in Queensland) that include a tourism enterprise. Cobbold Gorge is one example to the north of Rungulla National Park, and

Gilberton Outback Retreat another to the south of that. Rungulla National Park, on the Gilbert River south of Georgetown, is one of our newest additions, purchased with an Australian Government National Reserve System Program grant and gazetted in 2015. Sadly, that program was axed in 2012–2013 and has not been revived since.

Parks and protected areas should have more growth to come in Queensland, where only 25% of ecosystems are protected to a minimum standard, and less than half of nationally listed threatened species, leaving significant gaps to be filled (Taylor, 2017). Further strategic growth of parks and nature refuges in Queensland, with carefully chosen and well-justified additions like Rungulla and its neighbouring nature refuges, can only be good economic news for regional Queensland.

Conclusion

The economic future of the rangelands can be a diverse and sustainable future, and national parks have an important contribution to make in securing that future. The filling of significant gaps in a representative national park system across all bioregions, and particularly those in the rangelands, will contribute significantly to the sustainable management of the environment and maintenance of ecosystem services that benefit all Queenslanders. Attracting investment in carefully planned facilities for the rapidly growing grey nomad tourism sector, in conjunction with securing new rangeland parks, will help in diversifying regional economies.



Grey nomad tourism has potential to further contribute to the rangeland economy and to be enabled by national parks across each bioregion (Photo: P. Sattler).

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Author Profile

Martin Taylor worked on the successful *Salvinia* bio-control program with CSIRO and then pursued a career in evolution and ecology in the USA. Since 2004, he has worked for the National Parks Association of Queensland, the Australian Rainforest Conservation Society, and WWF-Australia where he currently is employed as a conservation scientist.

Native Forest Changes Affecting Apiculture and Crop Pollination

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Keywords: native forest, apiculture, crop pollination



Beehives on stands on the flood plains west of Goondiwindi, 1979.

Relevance

Governments have cited an aim of doubling agricultural production. The most feasible route to achieving this outcome is by increasing production of high-value horticultural crops, most of which depend on or benefit from insect pollination. Controlled pollination is dependent on the apiculture industry, which in turn is dependent on native flora for its continuity and production of apiary products.

Analysis

During my involvement with the apiary industry since 1950, and as a full time commercial migratory beekeeper from 1955 to 2008, changes in land use have caused a large change and some decline in the industry.

The industry has been further challenged by the incursion of a major exotic pest – the small

hive beetle – in 2000; two major bee diseases – European foulbrood and chalkbrood – since 1980; and the apparent effect of warming temperatures on vegetation. Industry decline, pests and diseases have reduced the availability of honeybees for crop pollination.

Accessing Ever-decreasing Resources

Coastal tea tree (*Melaleuca quinquinervia*) in wetlands was utilised by most commercial beekeepers in the 1950s and 1960s, including many from the Darling Downs. By 1970, exotic pine plantations had replaced much of this species. As well, increasing urbanisation caused the loss of large areas of productive forest. Because of the loss of forest resources, we moved our beekeeping headquarters from south-west Brisbane to the southern Darling Downs in 1969. At that time the adjacent Traprock and Granite Belt

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areas supported the most productive forests for the apiary industry. Yellow box (*Eucalyptus melioidora*), which produced large crops of highest-quality honey, grew here as well as a number of other productive species.

Yellow box had been given protection at a few trees per acre on Crown land in the 1950s. However, from the 1960s most of the Traprock lands were freeholded, transferring ownership of the trees to the landholder. Large bulldozers and the herbicides Tordon and Velpar became available in the 1970s, and an estimated 90% of this resource was cleared during the era of the Wool Reserve Price Scheme. The downturn in the wool industry following the failure of the Wool Reserve Price Scheme resulted in property amalgamations and the loss of a large percentage of the region's population. The clearing caused a parallel loss of apiarists and apiary production. We continued to produce by reducing stocking rates to utilise the remaining trees, many of which were on stock routes and public reserves. However, in 1988 we experienced the first failure to produce a crop from a reasonable flowering.

Apparent Warming Effect

When we moved to the Inglewood district in 1969, long-time residents had expectations of the first frost around the time of Anzac Day. We had occasions when all our water pipes were frozen. As time went by, this occurred less and less often – and never after 1990. First frosts came later and last frosts earlier.

Yellow box used to finish flowering around 10 December, and most production occurred from 1 November. The modest warming that was occurring caused the trees to commence flowering earlier, reducing honey production as much of the flowering occurred during the shorter, cooler days of earlier months.

While the level of warming that occurred seemed small, the *Eucalyptus* genus contains over 700 species, most of which have a limited range in which they prosper. I suspect the modest

change has had a major effect on species growing in specific locations.

It was instructive that on a trip to the Traprock lands in early November 2016, the last few flowers were on the yellow box, a month earlier than in the 1970s. Research reported by Phillips et al. (2018) (cited by Montaut, 2018) notes that flowers reduce their nectar production in drier or drought conditions, confirming beekeepers' field observations. The impact on all pollinators of the predicted increase in drought conditions expected to accompany climate change was particularly noted. Meanwhile, ClimateWatch, a collaborative program of the Earthwatch Institute in Australia, the Bureau of Meteorology and The University of Melbourne, reported that peak nectar flow occurred nearly four weeks earlier than in the 1970s. ClimateWatch researchers work with NASA and a network of beekeepers across the US and Australia. They attribute the shift in timing to climate change and, specifically, "the warming effect of urbanisation".

In my last 20 years of active beekeeping, we produced just four yellow box crops compared to crops at two- or three-year intervals previously. The Traprock region, which had supported many apiarists, had been cleared 'up hill and down dale', destroying a valuable resource and reducing biodiversity.

The woodlands of the Macintyre River flood plains west of Goondiwindi were a valued apicultural resource until cotton production commenced in the 1980s. While there were significant remaining native vegetation resources, cotton is highly attractive to bees, and insecticide losses made these areas unviable. We migrated further west to the Narran River catchment until cotton again presented the same challenge. From 1989 we had to travel much longer distances to access resources, as modern commercial apiarists continue to do.

Crop Pollination

Controlled pollination is dependent on the apiculture industry, which in turn is dependent on

native flora for its continuity. “Where are the bees?” has been a common question. Pests and diseases and pesticides have devastated the feral (wild) honeybee population, a previously helpful pollinator. Maintenance of a viable apiary industry is essential to ensure crop pollination for growth of the agricultural sector.

Prior to 1970 the Traprock region was the major area supporting the Queensland apiary industry. The extensive destruction of the region’s forests and woodlands has had a large impact on the apiary industry, now the major source of crop

pollination for expanding intensive agriculture and horticulture.

The region is the catchment for the Glenlyon and Coolmunda Dams. Rainfall in the catchment has declined, preventing farmers’ allocations downstream from being met. Allowing the Traprock forests and woodlands to regenerate as carbon stores, stabilising the catchment and its rainfall, protecting biodiversity and providing precious resources for the apiculture industry so critical for future crop production, may be a future for the region.

Conclusion

Queensland’s forest resource for apiculture continues to decline, and hives available for pollination of expanding insect-pollinated crops will not be available unless action is taken to increase forest resources and access to those resources. To the long-understood damage caused by clearing native vegetation, use of insecticides and lax biosecurity must now be added relentless climate change. There is no single cause and no single remedy, so coordinated policy action is required on many fronts.

Many parts of Queensland have been drought declared for much of the two decades of the 21st century. Biodiversity is in steep decline, and species once common are threatened. Many rural producers are financially stressed, and the Darling River catchment is struggling. Have we debilitated the land nurtured for 60,000 years by the first Australians by over-clearing and unrealistic expectations on the use of water?

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Author Profile

Now retired, Don Keith was a commercial apiarist for 53 years. He is a past Chairman of the Queensland Beekeepers’ Association, the Federal Council of Australian Apiarists’ Associations and the Board of Capilano Honey Limited.



Yellow box (*E. mellidora*) is a premium honey producing species which has been extensively cleared across the Traprock country. The restoration of this endangered box-ironbark ecosystem would provide multiple benefits including honey production, carbon capture and biodiversity.

(Photo: Bindi Vanzella)

Crucial Concepts to Be Considered When Developing Rangeland Policy

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Keywords: crucial concepts, rangeland policy, relevant research strategies

Crucial Concepts for Developing Rangeland Policy

1. *The foci need to be both strategic and tactical:* strategic for a rangelands-wide policy; and tactical where graziers and other land and resource managers are incrementally contributing to the wider strategy at a larger map scale, e.g. property, paddock, etc. (Hynes, 2015).
2. *With the exception of 'real' grassland systems, e.g. the Mitchell Grasslands, all other rangeland agro-ecosystems are expressions of keeping most of the land cover in a state of early succession.* This demands ongoing intervention by grazing animals and land managers, otherwise these systems would move through successional stages towards the original: tree-dominated or shrub-dominated landscapes. Fire may be employed in management; however, wildfires could further deflect successional patterns. Or if over-exploited, the systems will move into deeper levels of degradation. (Note: The State-Transition Model for sub-humid and semi-arid grasslands (Ash et al., 1993; MacLeod et al., 1993) partly addresses these ongoing management challenges. The Trigger-Transfer-Reserve-Pulse and Feedback Model (Ludwig et al., 1997) is also useful for sparsely covered semi-arid and arid rangeland systems, and partly addresses these challenges.)
3. *Agro-ecosystems that require ongoing intervention to maintain grass or pasture cover are always vulnerable to weed infestation* as the available solar energy, soil nutrients and water resources are never utilised to their full potential. These additional unutilised or under-utilised resources are available for woody weed invasion (Hynes & Scanlan, 1993).
4. *With climate change impacts accelerating, the policy strategy needs to anticipate, as far as possible, effective responses to enable long-term fluctuating agro-ecosystems to achieve stepwise but non-permanent equilibriums* as the effects of climate change put these ecosystems under continuous survival pressure.
5. *In the rangelands of the near future, some enterprises will need to be retired and property managers paid to manage the remaining bio-physical values, especially water resources,* not necessarily as national parks – there are probably enough already as these are usually under-resourced and endure very limited management of the spectrum of ecosystem values. However, it is acknowledged that national parks are usually established with specific objectives that are not generally achieved on private lands.
6. *In some rangelands of the near future, some enterprises will need to become mobilised to take advantage of intermittent rainfall events to move stock in and out of semi-arid and some sub-humid ecosystems that are suitable for such land use.* Kidman & Co – Outback

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Beef has been doing this for more than a century and continues this practice over the largest landholdings in Australia totalling 7.92 million hectares (Wagstaff & Carberry, 2019).

7. *In all other rangeland areas, pasture management strategies will need to rapidly adjust to enable optimum use to be made of shorter windows of production in a more unpredictable and fluctuating environment (Lauder, 2019).*
8. *At a strategic level: To enable landholders to prepare for these jolting changes, both state-wide and national strategies need to have visions based on understandings of whole-systems science which, in turn, have been translated into accessible, intelligent management approaches that have reasonable probabilities of success in ecological, social and economic terms.* Again, the problems are both reductionist (as in traditional science) and whole-system. And whereas scientists have long addressed the former level,

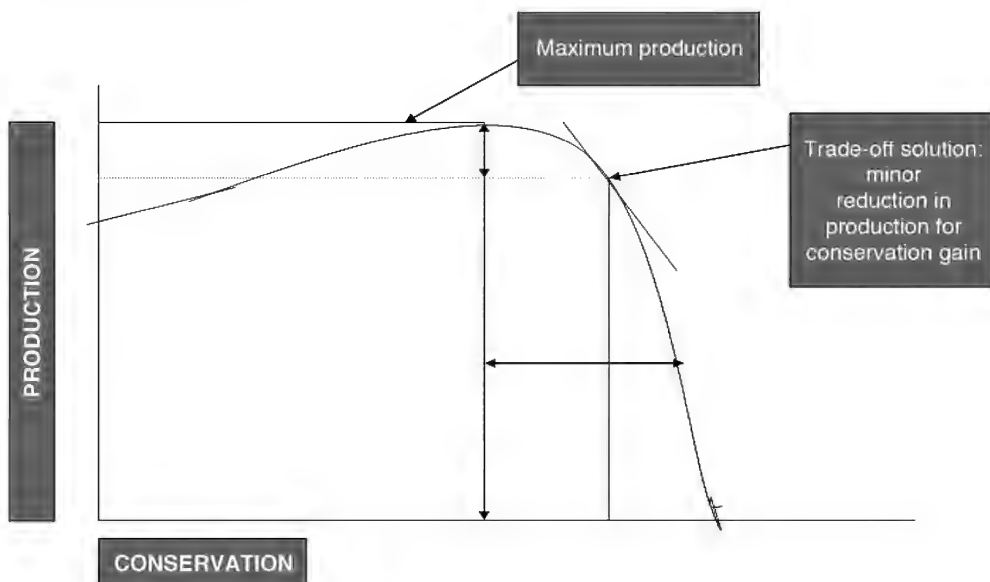
they have only recently started to develop wide-window understandings of whole systems by recognising and utilising big data and powerful IT-based systems (McCallan et al., 2019). There is great urgency here to invigorate and resource whole-systems science, if we are to contribute effectively to solutions to these pressing challenges (Hynes & Scanlan, 1993; Hynes, 2002; Hynes, 2004; Hynes, 2010).

9. *At a tactical level: Management approaches that address minor production trade-offs for specific conservation gains.*

The concept schematically introduced in Figure 1 was developed with Dr Graeme Kirby (then Chief Economist, Department of Agriculture, Stock and Fisheries, Northern Territory) for graziers and national parks rangers in grazing lands of the Tropical Savannas of Northern Australia in 1996 (Hynes & Kirby, 1996; Hynes, 2010).

Producers and conservationists in theory should be able to agree on thresholds of resource use, which enable trade-offs for whole-systems sustainability.

Figure 1. A schematic representation of possible trade-offs between sustainable production and ecological conservation (Hynes, 2010).



The objective is to convey an approach for land managers which would allow them to contribute to the survival of certain rare and threatened species by adjusting their management in scientifically based ways. The approach would maintain an acceptable level of cattle production, while strengthening the survival niches of species such as the northern quoll and a range of other small marsupials, as well as certain bird species, e.g. the golden-shouldered parrot and the Gouldian finch. Therefore, in special cases, for a relatively small drop in production, an increase in certain conservation values could be achieved. These should be applied where practicable, although these trade-offs may appear to be simplistic and are often rare options.

Discussion

Acknowledging the foregoing, it is almost impossible to effectively implement Concept 9 as presented in Figure 1 in complex, real-world cases. And the trade-offs that result are usually expedient and often politicised (e.g. the black-throated finch and the 'Adani' fiasco, regarding mining developments in rangelands and the potential loss of crucial habitats of threatened species, as well as unpredictable impacts on the hydrology of the development site).

Most systems exploited by humankind tend to move into deeper and deeper levels of entropy; however, they can be managed to sustain certain values for specific purposes.

The Carbon Flow approach to pasture management described and practised by Lauder (2020) can positively contribute to productive pasture conditions; however, it works best when kangaroos are excluded. Somewhat ironically, the history of land resource use, with its 'make better' practices of providing continuous bore-water or dam-water supplies, has artificially increased the carrying capacity of extensive areas of pastoral land in Queensland. This has influenced both livestock and native species and has led at times to plague levels in kangaroo populations (to the chagrin of graziers) and the spread of feral animals that threaten biodiversity.

Whereas some conservation values can be maintained in agricultural production systems, this varies with the land-use strategies, the nature and resilience of the land resources and associated water resources, the types of farming and the intensity of resource exploitation.

Capitalist trading markets and the demands created by high urban population pressure (both national and international) and the demand for food products tend to force farmers to seek the maximum short-term profit from their land use, usually to the detriment of ecological services and non-priced values (Hynes & Panetta, 1993; Hynes, 1997). Generally, farmers will claim otherwise, but 'when the chips are down' there is a natural tendency to pursue economic survival tactics. This type of pressure historically has accelerated the demise of whole civilisations.

Conclusion

Technological innovations – both intensive (e.g. artificial photosynthesis, vertical factory farming, advanced property-scale water management technology) and extensive (e.g. the various rangeland strategies submitted above in conjunction with modern advances in rangeland management) – may assist in holding levels of presently deepening entropy in our terrestrial and aquatic ecosystems. However, what is needed is a revolution in the way humankind produces food and fibre to satisfy its nutritional needs, and perceived tastes in food, fashions and habitation.

The current equations addressing resource use expectations do not add up. The economics of farming production are largely disarticulated from ecological services. In a global sense we are back to:

$$\text{Impact on the biosphere} = \text{population} \times \text{resource use} + \text{pollution}$$

This is the crudest summary of the big, complex, 'wicked' challenge facing humanity.

In the past the human species has responded to a wide range of environmental challenges; we need to recognise that it is now in an ecological and societal crisis! The solutions will need to be revolutionary, highly intelligent, strategic, adaptive and be applied immediately! The likelihood of achieving this vision seems frighteningly over-optimistic! Still, we need to get on with the job or witness increasing rangeland degradation and associated species extinctions.

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Dust storm in south-west Queensland reflecting wide-spread soil loss on pastoral rangelands.
(Photo: Charles Nason)

Author Profile

Past President, Royal Society of Queensland; formerly Director Research, Planning & Technical Services, Queensland National Parks and Wildlife Service; Director Research, Land Protection, Queensland Department of Lands; Deputy Director, Cooperative Research Centre for Tropical Savannas.

Mining Affects Rangeland Management and Integrity

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Keywords: unconventional gas, mining, aquifer hydrology, land restoration, weeds, human health



Coal seam gas wells crisscrossing farming land near Chinchilla.
(Photo: ABC News 16-12-2016)

Rangelands are a rich and often readily accessible source of minerals, coal and conventional and unconventional gas, and this has much potential for mining activities to impact the rangeland environment and farming of grazing animals. This gives rise to a conflict that is often an unequal contest because of the relative capital investment capacities of mining companies and grazing land resource managers. Mining always involves land disturbance of some nature, much of which is irreversible.

Mining often has a major impact on rangeland hydrology, often over a considerable area, e.g. increase in erosion propensity and fine-particle transport to streams and potentially the Great Barrier Reef; saline and acid water contaminant released inadvertently to the ground surface or to aquifers; and drainage of aquifers into voids created by the mining activity. This can impact

on landholders' ability to conduct their enterprises effectively and sustainably. It can also affect the value of their land tenure through the environmental damage making the grazing enterprise less profitable.

The mining companies' efforts to gain access for exploration and production activities can lead to stress on families such that they feel forced to sell their land to the mining company in order to minimise the effects on family health. This is usually done with a nondisclosure confidentiality agreement regarding the conditions of the sale contract. Proximity to mining activity *per se* and having coal seam gas (CSG) wells on a property (or neighbouring property) reduce land valuations, affecting the ability to borrow money and driving down property land values towards a negative equity outcome. Mining company property 'buy-up' also affects the

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fabric and health of rural communities (Haswell & Shearman, 2019).

It is difficult for mining companies to restore the land they have used to something approaching the original environmental values, and very few cases of land restorations have been signed off by government as successful. The Queensland legislation on mined land rehabilitation partially addresses this for new activities through financial provisioning, but appropriate risk assessment based on the precautionary principle and local community engagement is needed to ensure that the mining occurs with least impact on the environment and that rehabilitation occurs satisfactorily, e.g. such that voids are filled in and not left. Some existing voids perform a useful role in pumped hydro production of electricity. The legislation around mining does not address industry insurance to ensure that landholders are adequately covered for impacts of mining. Landholders themselves are unable to obtain such insurance, e.g. against soil and water contamination by CSG mining and loss of aquifer (well) water. This affects land valuations, investment and future land use. (Governments themselves often require sureties from mining companies for environmental damage, but are these adequate?)

Mining uses large amounts of water, and this is often competitive with other land-water uses. Aquifer drawdown is a major issue because of the long time taken for recharge, and it affects lateral flow of water into streams and springs. Much of the rangeland water accessed for mining processes is from the Great Artesian Basin, and interconnectivity of aquifers within the Basin is an issue affecting available water quantity and quality, particularly in the Channel Country. Fracking for unconventional gas (shale and CSG) water requirements, estimated in the USA to be between 42 and 90 million litres per shale gas well (Ingraffea, A. R., Cornell University, pers. comm.; Kondash et al., 2018), places a large burden on water resources in Australia (and road resources, as this water may be trucked in). The CSG industry in Queensland

is now extracting 60,000 megalitres of produced water per year, and the way this is used, along with the disposal of the salt produced (by reverse osmosis remediation of produced water to enable disposal to waterways or agricultural/environmental use), is very controversial and not yet settled. This water is a public good but is not managed as such (Monckton, 2019). The aquifer 'make-good' agreements in land access contracts between mining companies and landholders do not ensure restoration of the loss of aquifer water, only a monetary compensation, or a new bore – maybe into another aquifer if available. The number of bore drawdowns from CSG mining is increasing, with significant impact on 571 water bores predicted for the Surat Basin (Office of Groundwater Impact Assessment, 2019).

Mining-related seismic events are a more regular occurrence than usually acknowledged and are another risk for aquifer integrity, with the faults opened up allowing water and the contained contaminants to move between aquifers (e.g. Concerned Health Professionals of NY, 2019).

Mining company vehicle movement poses a very large risk to biosecurity and particularly the spread of weeds such as parthenium (Bajwa et al., 2018; <https://www.abc.net.au/news/rural/2014-02-10/csg-weeds/5249638?site=southqld>). CSG mining companies have moved onto properties to establish pipelines without washdown, and this causes landholders considerable distress. Washdown of vehicles is required but not policed/monitored, and facilities are often not available or do not provide adequate cleaning (Khan et al., 2018).

Fugitive emissions are not adequately measured on a continuing basis, and usually baseline measures are not taken before mining starts. Such fugitive emissions contain not only greenhouse gases with a drastic feedback effect on weather events (drought, severe rainfall intensity and flooding), but also volatile organic compounds (VOCs) which can affect human and animal health as the Linc Energy underground gasification case illustrated (see also Haswell & Shearman, 2019).

An aspect of unconventional gas extraction is the potential for blow-outs. Capping wells with cement concrete may not cut out fugitive emissions as concrete shrinks, and bentonite is currently being assessed as an alternative. The concrete lining of the metal tube in the well also can allow fugitive emissions to flow through an inadequate sealing against the rock wall. In the

USA, research published by the EPA and other organisations showed that aquifer contamination and fugitive emissions occur with fracking for shale gas extraction.

Agro-economic modelling by the CSIRO of the effects of CSG mining in Queensland's rangelands showed that losses of up to 10.9% of agricultural revenue could occur (Marinoni & Garcia, 2016).

Conclusion

Mining for minerals (especially coal) and unconventional gas can alienate large areas of good-quality agricultural land and deplete and contaminate water resources used in farming and by natural ecosystems. Mining can also introduce weeds into ecosystems. Fugitive emissions of greenhouse gases resulting from mining are considerable, contributing to climate change which is affecting land condition. Mining is a short-term land-use phase and rarely is mined land rehabilitated to re-establish the original land condition and ecosystem function. Dealing with mining companies over land access and competition for labour is often a very stressful process for landholders, impacting on their health with considerable flow-on costs to the community. Mining changes the dynamics of rural community socioeconomic systems.

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Author Profile

Peter Dart, School of Agriculture and Food Sciences, University of Queensland, is concerned about the loss of good-quality agricultural land to mining and the associated detrimental effects on the environment, particularly on soil quality, hydrology and fugitive emission effects on air quality and climate change.



Earth Charter Australia

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Keywords: sustainable wildlife ownership, integrated wildlife management

The Earth Charter and Sustainable Rangeland Management

The Earth Charter is an ethical framework of values and principles for building a just, sustainable and peaceful global society. Ecological integrity is covered under Principles 5 to 8:

5. Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and natural processes that sustain life.
6. Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach.
7. Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being.
8. Advance the study of ecological sustainability and promote the open exchange and wide application of the knowledge acquired.

There are many sub-principles of the Earth Charter Principles that provide more detailed sustainable management guidelines.

Rangeland Policies

1. Economics significantly impact, mostly negatively, on rangeland management, and therefore economic policies (e.g. taxation, level of debt) need to be reviewed. For example, taxation incentives for cultivation machinery purchase may make crop farming relatively more profitable than grazing and subsequently lead to rangeland degradation.
2. Respect for all biological life requires a major understanding of our native wildlife and the integrated management of wildlife and domesticated animals. Integrated management may require a major change in the 'ownership' of wildlife, so that landowners may 'sustainably harvest' wildlife as part of integrated rangeland management or be paid to sustain wildlife. Sustainable management practices require landowners to effectively manage all grazing animals including wildlife, in this case kangaroos. Landowners will need to become key partners in the management, harvesting and market development of a successful kangaroo products industry. In other words, *wildlife is valued and not considered a pest*.
3. A focused rangeland policy approach is required that relates to the unique ecosystems and landscapes of Australia's Outback: *one policy does not fit all*. A regional approach is needed that engages all stakeholders and influences the policies of state and national bodies in recognising the unique and strategic value of our rangelands.

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4. Water is a major resource for rangeland management. Ensuring a sustainable water supply requires management and research of both above- and below-ground water resources, and *when knowledge is limited, apply a precautionary approach.*

“The global environment with its finite resources is a common concern of all peoples. The protection of Earth’s vitality, diversity and beauty is a sacred trust” (The Earth Charter).

Conclusion

A focused rangeland management strategy is needed by state and national bodies that recognises Australia’s unique ecosystems and outback landscapes and provides for the integration of wildlife in sustainable rangeland management systems.

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Thrushton National Park, a key representation of the ‘soft’ Mulga Lands (Photo: DEHP).

Author Profile

Clem Campbell has worked as an agricultural economist with the Queensland Department of Primary Industries in Roma; an executive and research officer with Bundaberg Canegrowers Ltd; a research and development officer with Bayer AG; and a member of Ministerial Primary Industries Committees, Queensland Parliament.

International Year of Rangelands and Pastoralists

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Keywords: rangelands, pastoralists, United Nations, International Year Declaration



Samburu pastoralists, Kenya (International Livestock Research Institute).

A dedicated International Year of Rangelands and Pastoralists (IYRP) would open up opportunities to highlight the complexities and values of rangelands around the world, as well as here in Australia. Even though rangelands cover over half the earth's land surface, rangeland issues are a low priority for governments. Some policies contribute to land degradation, e.g. the forced settlement of mobile pastoralists such as transhumant herders in Africa and China. Decisions are often based on a lack of understanding of these often dry and remote environments, and this 'benign neglect' was highlighted at a recent United Nations meeting (Johnsen et al., 2019). The knowledge and culture of rangeland communities are also poorly understood.

Rangelands around the world support an estimated 500 million to 1.5 billion pastoralists,

and they are among the world's most marginalised people, both politically and economically. Approximately half of the world's livestock is managed by pastoralists, upon which their livelihoods and food security depend. In the face of increasing land use pressures, climate change, and growing economic and population burdens, pastoralists and their habitat are under duress.

The Government of Mongolia is calling for an IYRP to increase global recognition of the importance of both the rangelands and the pastoralists who use them. In Mongolia, approximately 80% of the landmass is rangelands, and pastoralism is a primary way of life. Its government well understands the value of rangelands and the need for appropriate management, including the benefits of pastoralists' moving livestock as the different seasons and years require.

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Widespread Support

Now that the Government of Mongolia has made a proposal for an IYRP to the Food and Agriculture Organization of the United Nations (FAO), it is calling for support from countries and organisations around the world. A decision will be made by the United Nations in 2020, so time is critical.

Momentum has been building at various events internationally as a result of ongoing efforts by the IYRP Support Group and partners, including FAO, the International Union for Conservation of Nature (IUCN), the International Livestock Research Institute (ILRI), the International Centre for Agricultural Research in the Dry Areas (ICARDA), the Coalition of European Lobbies for Eastern African Pastoralism (CELEP), the International Rangeland Congress (IRC) and the International Grassland Congress (IGC).

Side events at the United Nations Environment Assembly (UNEA 2 and UNEA 4) led to an agreed resolution calling for increased global efforts to conserve and sustainably manage rangelands. In 2019, the ongoing effort for a UN-designated IYRP was acknowledged. The United Nations recently designated 2021–2030 as the Decade of Ecosystem Restoration – a global call to action to reverse the degradation of up to 350 million hectares of deforested and degraded land, including rangelands, in an effort to combat climate change and preserve biodiversity.

Benefits for Australia from an IYRP

Australia's participation in an IYRP will further enhance our already high reputation in pastoralism and agriculture. The Australian rangelands or 'Outback' covers about 80% of the continental landmass and gives Australians a 'national sense of place'. Six World Heritage sites provide tourism opportunities, and mining is a major industry. Our rangelands produce agricultural exports of approximately \$90 billion annually to the national economy, by supporting various industries including 11.8 million cattle (43% of the national herd) and 7.1 million sheep (10% of the national flock).

An IYRP has many benefits for Australia, including the opportunity to showcase and market:

- clean, 'green' products of meat and wool produced by the 6,000 pastoral businesses, including the world's largest area of certified organic rangeland production (about 10 million hectares);
- rural business skills, as Australian rural people are the most productive and entrepreneurial in Australia (a typical rural resident contributes \$80,000 in goods and services annually, with one innovative business to every 14 people, compared to the national average of one in 32 people);
- agricultural business management and modelling tools, such as the 'digital homestead' and precision pastoral's eTrend® technology which combines remotely recorded cattle liveweights and pasture information – tools that are now being exported around the world;
- tourism opportunities in the Australian Outback with its iconic Australian animals, conservation areas and cultural heritage, e.g. Indigenous culture and the wide-open spaces of the Australian rangelands;
- Australian expertise in developing alternative rangeland industries, valued at ~\$200 million annually from such enterprises as harvesting bush/native foods, cut flowers and feral animal harvesting;
- Australian agricultural training and university programs in rangeland science and large-scale grazing management, including providing tertiary qualifications for international students;
- world-leading carbon management programs, including the use of Indigenous knowledge of fire management to mitigate carbon emissions from tropical grasslands, and Emissions Reduction Fund projects aimed at sequestering carbon by revegetating rangelands; and
- Australia as the power plant of the future,

with opportunities to export solar power and provide a major carbon store; with high sunlight intensities, e.g. through Clean Energy Innovation Fund co-investment.

Rangelands are the focus of much research which aims to increase agricultural productivity, address economic and environmental issues, and develop sustainable livelihoods for rural and regional communities.

In addition, the IYRP will contribute internationally to the achievement of the UN's Sustainable Development Goals, in particular:

- *Rights of pastoralists* (SDG 1, 2, 5): The lack of land rights is a huge challenge for pastoralists in countries of the Global South [meaning 'Third World' or developing countries (Dados & Connell, 2012)], with the lack of rights posing big threats to pastoral sustainability and viability.
- *Importance of people* (SDG 15): In helping to "... combat desertification, halt and reverse land degradation, halt biodiversity

loss" and the need for multilateral environmental agencies to cooperate.

- *Ensuring availability and management of water, and sanitation for all* (SDG 6): Australian water expertise is well recognised and could assist in: helping to achieve equitable access to safe and affordable water (SDG 6.1); increase water-use efficiency in all sectors (Goal 6.4); protect and restore international cooperation and capacity building to support developing countries in water harvesting; recycling and many other activities (SDG 6.6).

Rangelands are important globally, as remote drylands provide valuable grazing lands for livestock and native wildlife. As well as extensive animal industries, these areas support major mining industries, contain some of the world's largest rivers and sustain pastoralists with diverse cultures, such as Australian graziers and pastoralists, Mongolian herders, African nomadic peoples and Scandinavia's Sami reindeer herders.

Conclusion

In Australia, an enhanced profile for rangelands, their industries and communities would contribute to a growing national awareness of their significance, an increase in investment to support their sustainable use, and an international awareness of the contributions that the Australian experience can make to the management of a major biome globally.

For further information about the proposed international year, click on this link: <https://globalrangelands.org/international-year-rangelands-and-pastoralists-initiative>

Organisations are encouraged to express their support by writing to the Government of Mongolia:

*Mr ULAAN CH., Minister for Food, Agriculture and Light Industry of Mongolia
Government of Mongolia, Ulaanbaatar, Mongolia*

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Managing Extreme Natural Events

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Keywords: management, preplanning, dam, flood

I invite you to consider macro-management of extreme natural events in the light of three recent scenarios; and I elaborate on the third with respect to timely and appropriate decision making that relates to better pre-planning, preparation and management to prevent drastic last-minute responses which may be spasmodic, uncoordinated, chaotic and incomplete. Management and planning must display through policy and adequate funding of simulated exercises:

- (a) knowledge
- (b) training
- (c) responsibility
- (d) authority.

All scenarios are designed to show systemic failures applicable to rangeland management and the need to change attitudes and behavioural responses in what can be desperate situations.

This need is further highlighted by a presentation at the Rangelands Policy Dialogue in Brisbane by eminent meteorologist and climatologist Professor Roger Stone, Director of Climate Studies at University of Southern Queensland, who revealed that north-western Queensland experiences the most highly variable climate in the world and that the variability is increasing (Stone, 2019). This means that rainfall and other events that exceed the parameters of previous experience will become more frequent and will test the capacities of public authorities, especially the emergency services.

Separate data, published by the Actuaries Institute, reveals that the frequency of extreme weather in the country's worst-affected regions has doubled compared to the long-term average (Ting et al., 2019).

"There's clear evidence that we're getting more extreme maximum temperatures, fewer extreme minimum temperatures" (Tim Andrews, head of Finity Consulting, which compiled the information for the Actuaries Institute; Ting et al., 2019).

Landholders in the semi-arid north have traditionally been focused on rainfall as the limiting factor in the growth of pastures and hence the success of their enterprises. The future trajectory of average rainfall in northern Queensland is still opaque, but the likelihood of extreme events is now not in doubt.

The extremes in northern Queensland and elsewhere in the rangelands are highlighted in the three case studies:

Scenario 1

The recent fish kill in the Darling River and associated streams with the loss of more than one million marketable native fish and community impacts on population sustainability and future viability.

Scenario 2

The loss of 600,000 or more cattle through drought, flooding and disease in the north and north-west of Queensland in particular, and the

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loss of transport access by road and rail, including losses through subsidence of saturated land.

Scenario 3

The Near Miss of the Townsville Floods

Note: My analysis of the events is from published information (Townsville Water & Waste, 2019; Michael et al., 2019). All the calculations not published are mine, as are the assumptions made.

The Ross River Dam Emergency Action Plan

- The *Ross River Emergency Action Plan 209/2020* (EAP) states that the dam full supply level (aka height of river) is reached at 38.55 metres (EAP, p. 32) and all the dam gates are fully opened when the elevation reaches 43 metres (EAP, p. 34).
- The standing operating instructions indicate that if the dam level reaches 43.6 metres or the flow is then in excess of 2100 m³/sec, steps must be taken to evacuate everyone in the immediate vicinity of the dam (EAP, pp. 34, 35).
- If the water level reaches 47.5 metres, dam failure is extremely likely (EAP, p. 34).

The Townsville Flood

- The height of the Ross River at the dam reached 43.0 metres (248%) on Sunday, 3 February at 7.20 pm and subsequently peaked at 43.03 metres (251%) at 11.50 pm (BMT, 2019, p. 31). The dam floodgates opened automatically, as they were designed to at this level (43.00 metres; EAP, p. 34), and water flow was in excess of 1900 cubic metres per second. I estimate the maximum flow was in excess of 2030 m³/sec at 2.00 am.
- “Up to 20,000 homes have been evacuated as the Townsville flood crisis worsens. It’s now the region’s worst flood ever, recording more than 1 metre of rain in the last week. The gates of the Ross River Dam opened automatically overnight, after days of relentless rain” (7 News, 2019).
- When the Ross River Dam floodgates opened automatically, who knew?
- Who had prior warning one hour before, eight

hours before, 12 and 24 hours before and even three days before?

- What communication took place before the floodgates opened?
- Does this suggest a possible scenario for the public not being warned that the floodgates were going to open and explain why so many people had to be evacuated in the dark, why police on the street were caught unawares, and why cars parked on the streets which could have been moved to higher ground were unnecessarily damaged and the subject of numerous avoidable insurance claims totaling thousands of dollars?

Conclusion

As one contemplates these three scenarios, the challenge is to decide what would have been timely and appropriate action with regard to the initial criteria. What training is necessary for decision makers to be adequately prepared?

What would have happened if the floodgates had not opened automatically or were damaged and could not open? I estimate that the critical level of 43.6 metres could have been reached as early as 8.42 pm.

With saturated ground, the level for dam failure could actually be lower than 47.5 metres. I have used 47.5 metres as the level at which failure occurs; this may have happened between 1.00 am and 2.00 am on the Monday morning. This would have meant that more than 100,000 people in Townsville would have been swept out to sea in the dark.

While the seriousness of the first two scenarios is not to be underestimated, the scale of the worst-case scenario in relation to Townsville flooding would be even more devastating. People might find whole suburbs uninhabitable, together with associated problems, and no satisfactory solution in sight.

Moreover, early-warning advice and effective planning for evacuation before the release of dam water could have avoided the situation where people suffered unnecessary damage and

losses. The opportunity was not provided, and motor vehicles and property became the subject of insurance claims.

I maintain that there is a need for management policy to include funding for simulated exercises on a regular basis to maintain competency and

to mitigate the effects of any future disastrous events.

Macro-management of extreme natural events is essential. This includes pre-planning and management to avoid uncoordinated and chaotic responses.



Increasing severity of flood events are predicted with a changing climate (Photo: C. Nason).

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The Last 50 Years of Pastoralism: What Impact Drought Strategies?

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Keywords: drought strategies, sustainability, stock losses, national carrying capacity, stubble grazing

The Last 50 Years

As at 30 June 2016, there were 25 million head of cattle and 70.9 million sheep in Australia (ABS, 2016), i.e. around 34 million adult equivalents. The data for 2019 are not yet available, but all indications are that there will be a further reduction after this current widespread drought. It seems each ensuing drought takes a toll, and while stock numbers are the statistic which attracts most attention, it is deterioration of the rangelands which should cause most concern. The cumulative effects of each drought episode are analogous to a boxer's attempts to survive as more blows are landed. In our lifetime, the national numbers have tumbled from 33 million head of cattle and 180 million sheep in the 1970s (around 55 million adult equivalents) to current levels. The question which needs to be asked is: "Could we ever sustain these stock numbers again in Australia?"

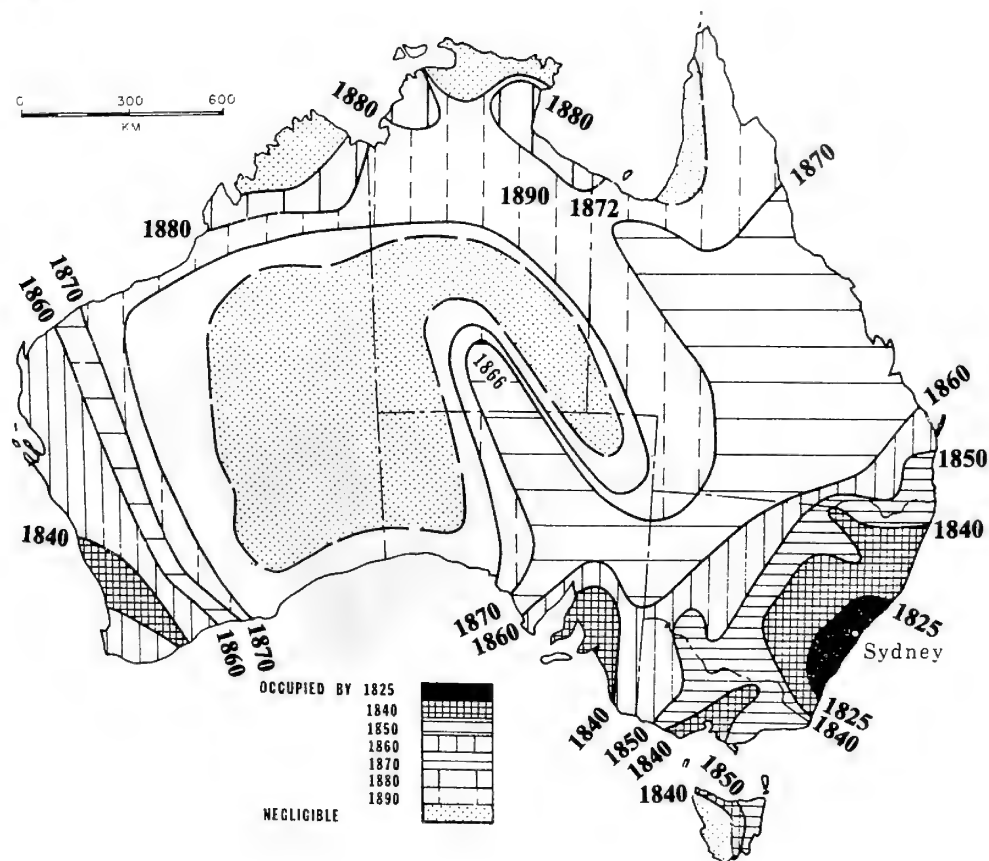
Evolution of a Pastoral Industry

An historical examination of the grazing industries (Williams, 1982) provides insight into how we have arrived at this point (Figure 1).

From its meagre beginnings of a bull, bull calf and four cows in 1788, the Australian beef herd evolved slowly over the next 50 years and was restricted to the major regions of settlement in New South Wales, Victoria, Western

Australia and South Australia. However, with the cessation of transportation of convicts in the mid-1800s and expeditions by early explorers such as Sturt, Mitchell, Stuart, Leichardt, Forest and Kennedy, pastoralism exploded in the next 40 years, and by 1890 most of the grazing lands in Australia had been opened up (Figure 1). By 1862, both New South Wales and Victoria were grazing about six million sheep each, with Queensland only a little behind. Between 1860 and 1894, the whole sheep population had risen from 20 million to 100 million, and the cattle from four million to more than 12 million. The great drought from 1895 to 1902 reduced the sheep population by half, and much of the western districts of New South Wales were virtually destocked (Williams, 1982). In 1901 with the federation of the states and the emergence of a new nation, sheep numbers again accelerated as wool production was much more amenable to the development of a thriving grazing industry and success was not dependent on processing plants, refrigeration, inland roads or domestic markets. The national flock peaked at 180 million head in 1970, but declining global demand, rising costs of labour, deteriorating land condition and increasing predation have seen a marked decline in both the size of today's sheep population (70.9 million) and the regions now suited to sustainable sheep production.

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Figure 1. Stages in land settlement (Williams, 1982).

Meanwhile, the metamorphosis that occurred in the beef industry has been equally interesting. As refrigeration and shipping improved, export markets were developed and stock routes sprang up through the north, creating corridors through which the beef industry could effectively operate. Beef production gradually replaced wool in the northern regions less suited to sheep, and the national herd grew slowly to around 16 million head by 1960. Vast breeder operations were established in the dry tropical zones, and these supplied store steers into the fattening regions of the channel country which were located closer to processing facilities on the eastern seaboard. Great Britain was the

main importer until its entry into the European Common Market in the mid-1950s. This necessitated the development of new markets in the United States and Japan, which created demand and stimulated a rapid expansion in cattle numbers between 1960 and the infamous 1974 beef slump when the national herd reached its peak of 33 million head. Beef roads were developed and the stock routes gradually disappeared, though they were still significant in Queensland as a key resource. The eradication of both tuberculosis and brucellosis, along with the change in genotype, meant that northern Australian cattle were highly adapted to the environment and suited to the live export trade in South East Asia.

Advances in pump technology, polyethylene pipe, supplementation, a botulism vaccine, road trains and weaning improved the ability to manage droughts and reduce stock losses – but at what cost? Management strategies developed with the intention of averting major stock losses from drought by more efficiently utilising available pasture reserves; this meant existing stubble could be grazed to ground level. Government policies on fodder and freight rebates were designed with every good intention to keep stock alive and ensure business survival, but at the expense of long-term sustainability because each widespread drought would progressively remove more perennial pastures. It was thought that massive stock losses (25,000 head), as occurred in the 1958 drought on Brunette Downs (Henty 1963), could now be avoided.

What Has Changed Since the Sixties?

The factors leading to the apparent loss of carrying capacity in the rangelands are multi-factorial but include:

1. An increase in the capital value of the land in comparison to the value of the stock means less funds directed at working capital and more into financing an asset that is losing productivity.
2. Development and the continued utilisation of new country reduce the reserves available in years of widespread drought when feed is scarce.
3. Supplementation, efficient transportation of fodder and development of underground water supplies have enabled stock to be retained on pastures far beyond their capacity to regenerate.
4. A change from *Bos taurus* to *Bos indicus* breeds, along with their hybrids, in the dry tropics has allowed better survival rates in drought but perhaps to the longer-term detriment of the pasture ecosystems on which they graze.
5. Stock can be transferred farther afield –

placing more grazing pressure on pastures in other regions previously not under threat.

6. Major stock losses have been avoided but at the cost of reduced opportunity for subsequent pasture regeneration. It takes literally years in arid regions for pastures to recover (Figure 2).
7. Intensification of water use, including increased numbers of borehole pumps and the loss of water from open bore drains, has lowered water tables and caused natural streams to stop flowing sooner.

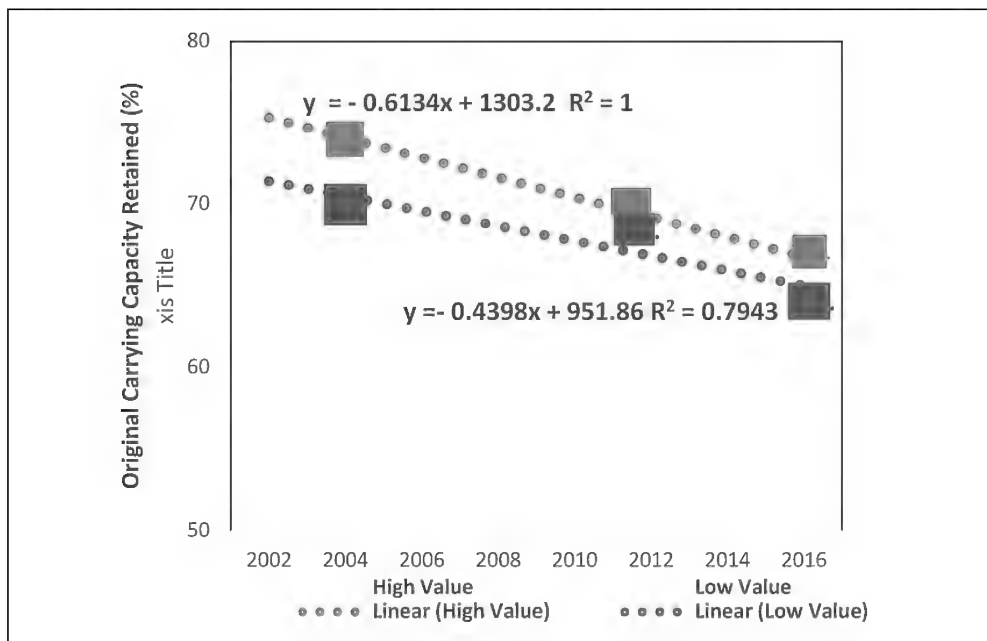
A Change in Focus Is Needed

The development of lot feeding and live exports now ensures that markets exist for store steers which would have been retained previously in widespread drought. This should have improved our ability to manipulate stocking rates, provision for spelling country, manage drought periods and stabilise the nation's carrying capacity. Notwithstanding, there are examples of pastoral businesses successfully operating in arguably the most variable rainfall regions in Australia where drought is commonplace. One such region lies south of Alice Springs, extending into northern South Australia. The rainfall gradient ranges from a 256 mm long-term average at Alice Springs to 171 mm at Kulgera on the South Australian border. Further, the rainfall is truly non-seasonal in this region, where any amount may fall at any time. Droughts are a common feature. A 12-year study in this region (Holmes, 2014) showed that the businesses with the lowest stocking rates generated higher whole-business profits. The study period included a six-year drought, and it was also found that the drought recovery period was significantly shorter in those businesses with the lowest stocking rates. The reason for this is that the herd inventory remained more stable and returned to full production capacity sooner. The relationship between profit and pasture availability was strong.

Figure 2. Pasture regeneration at an enclosed monitoring site (Goldfields, WA) after 25 years.



Figure 3. Change in proportion of original carrying capacity retained at the 3 assessment times for high grazing-value land types (grazing value >5) and low-value land types (grazing value ≤ 5) (Shaw et al., 2016).



Prudent management of grazing pressure is fundamental to maintaining land condition. A series of surveys across the northern Gulf region (Shaw, 2016) suggests that carrying capacity has declined over recent decades from 72% to 66% (Figure 3) with deteriorating land condition. If the trend continues, 50% of original carrying capacity could be lost by 2046 in this region.

The focus needs to turn from management of livestock to management of pastures. When the health of the pastures is centre stage in management and drought planning, sustainability of

rangeland enterprises can be achieved. It's not the ability to predict the seasons that is paramount but the necessity to understand pasture growth curves, adjust stocking rates according to pasture availability, develop long-term carrying capacities, implement suitable spelling practices and make early decisions based on well-established critical trigger points before livestock become unsaleable. The golden rule for sustainable pastures as advocated by Bill Burrows is still relevant: "Ensure you come out of a drought with stubble on the ground."



No stubble coming out of drought – no recovery of pastures.

Conclusion

It would appear that despite advances in transport, feed options and livestock management, grazing strategies used in European systems cannot be successfully applied to the highly variable rainfall environment that exists in arguably the driest continent on earth. Drought is not a novel phenomenon, but the impact of successive droughts, the lack of resilience and the apparent loss of land condition present new challenges that need to be addressed by the pastoral industries in the 21st century.

Examples exist which demonstrate how this can be achieved. It is paramount therefore that custodians and managers of the rangelands develop sound drought management plans that focus primarily on preserving native pastures and land condition – similar to biosecurity requirements. Assistance packages and drought relief should embrace measures that demonstrate prior planning and ‘best practice’ grazing management.

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Transition and History in the Grazing Industry – Then ... and Now?

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Keywords: land management, long-term ecology, physical geography, family history, case studies

Much research is constrained by academic and professional restrictions, not least by sources of funding and by geopolitics. Accordingly, the ability to locate the research on a very long timeline is limited. Such research tends therefore to reflect a point in time, albeit stretched over years but less often over decades or centuries. Many of the ‘wicked problems’ which face the large-scale grazing industry are the outcome of previous land management over the history of up to 80% of Australia. The intuitive knowledge of the original occupants of Australia developed over thousands of years of management must be valued in the context of today and the future. Their management establishes a threshold to assess future land management, in this case for large-scale grazing of the rangelands. This assessment can be informed by the use of case studies including the history of my relatives who settled and worked across the rangelands.

This story begins when, after landing in Adelaide in 1835, the first of my Cudmore relatives established various business and agricultural ventures in Adelaide and beyond (Yeates, 1979). The first of my Yeates relatives arrived in 1839 and also established in Adelaide. These families were then connected by a marriage of their children. It seems there was a certain common pioneering spirit following relatively successful pursuits in South Australia, including at ‘Baroota’ near Mt Remarkable and as far away as the Murray River. By 1861, Cudmore interests had taken up ‘runs’

along the western tributaries of the Burdekin River. In 1862, my great-grandfather Sidney Yeates and other relatives set sail for Bowen via Sydney, where several of the Yeates men set out to collect stock and equipment from ‘Goonoo Goonoo’ near Tamworth, their destination overland being leases totalling 250 square miles, east of the Gilbert Range and west of ‘The Lynd’ and ‘Carpentaria Downs’, including ‘Myall Downs’ at the junctions of the Lynd, Copperfield and Einasleigh Rivers (Yeates, 1979, pp. 21–23), arriving in 1863. More recent information suggests that this may have been encouraged by the need for fresh meat during a nearby short-lived mining rush, but this is unconfirmed. The venture was also short lived, as other products (tallow and hides) proved uneconomic. The leases were sold in 1867.



Mustered sheep near Adavale (Photo: Facebook, Adavale – Outback History Southwestern Queensland).

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The families moved back to the area where others in the Yeates family were well established near Bowen on the Don River and farther south (Yeates Creek), but this area proved too wet for sheep, so for a period the Yeates families did well enough with mixed farming to support a growing population in Bowen. However, ventures farther south-east proved difficult, with increased thefts of stock and lack of reliable workers. Family notes indicate an increased interest in the south-west grazing lands in Queensland (SWQ) that were being made available. By 1880, influenced by Daniel Cudmore (senior) who it is understood already had interests in SWQ, my great-grandfather Sidney Yeates and his family prepared to move stock and equipment again, this time to the area near Adavale. They departed on 15 October 1880 and arrived on 2 February 1881 to take up the leases collectively known as 'Boondoon', totalling 553 square miles located east of Blackwater Creek, 'Wakes Lagoon' and 'Milo' (a Cudmore property 8 km west), with 'Listowel' to the north, 'Ambathala' to the east and 'Gumbardo' to the south, and Boondoon homestead about 12 km from Adavale (Yeates, 1979, pp. 42–44).

Detailed descriptions of Boondoon are recorded and provide a very detailed description of the land, both at that time from regular inspection by government officials ensuring lease conditions were being met, and from Neil Yeates based on his expertise and his visit to the area in 1978 (Yeates, 1979, pp. 42–45). Arriving in what my great-grandfather described as an "awful drought" could not have been welcoming. Having purchased the leases for £10,000, including 3000 cattle, the Yeates family set out to convert the land to carry their flock of sheep. Yeates provides vivid descriptions and reports that suggest, at best, the property in the 1880s was what might be described as marginal, i.e. it could support a family-run operation despite difficulties such as reliable water being too far from good native pasture.

As Yeates (1979) puts it, "... it is clear that

Sidney (Yeates) and his sons embarked on a herculean task in deciding to develop 'Boondoon'." Besides being rough topographically and of only light carrying capacity, the run was described as "inadequately watered". Water certainly appears, from all the descriptions, to have been insufficient or unreliable in dry seasons (Yeates, 1979, p. 44). Precise descriptions of the topography, geology and vegetation at the various blocks are given, together with their location (pp. 44–45).

Yeates (1979) also notes that at its peak Adavale was a thriving town with a population of around 180, a major Cobb & Co and teamsters' depot and a busy centre of trade (p. 46). It had a hospital, school, police station and several hotels. Sidney Yeates was a strong supporter of the trans-continental 'Great Western Railway (GWR)' proposal of McIlwraith and others (p. 46). In New South Wales, this is the Main Western Railway from Bourke to Sydney, a means to redirect trade from the Darling River and thus from Adelaide. The proposed GWR was intended to extend from Bourke to Darwin, with links to extensions of the various east–west railway lines in Queensland. Despite the successes of similar ventures in opening up and supporting more intensive grazing and farming across the USA, Canada and South Africa, perhaps unfortunately, the proposals were not supported. However, the line from Charleville was extended to Quilpie ca 1911, thus bypassing Adavale. The decline of Adavale and similarly significant towns is linked directly to the local and regional economy making such places vulnerable to economic and political events and loss of services. In this case, the GWR project stalled with World War 1 and was never completed. By 1978, Adavale was "almost a ghost town", and along with the deterioration of the properties such as Boondoon (where nobody now lives), the homestead and the many "improvements" to the property over the years are in the final stages of decay (Yeates, 1979, p. 46).

While Boondoon is reported as carrying up to 45,000 sheep, Milo at its peak had 566,217 sheep shorn in 1892 and was carrying up to 45,000

cattle. This was before government requirements led to the breaking up of the large agglomerations. These include those associated with Milo and Gooyea and with such names as Elder, Smith and Cudmore, leading to the formation of a sequence of corporate changes including Milo and Welford Downs Pastoral Company Limited with over 4000 square miles of mainly cattle properties. However, serious floods followed by the major drought of 1893 led to huge losses, including some 160,000 sheep lost due to drought on Milo (Milo Pastoral Company Limited, 1963). By then, however, the Yeates interest in Boondoon had been disposed, with several members of the family moving to rural interests in Charleville, Springsure and elsewhere in Queensland. Sidney Yeates retired to Toowoomba (Yeates, 1979).

The next step relates to records kept of Milo and Ambathala, which indicate an annual average rainfall of 15.51 inches over the 80 years from 1880 to 1960, with the best rainfall in one year, in 1950, 44 inches which included 12 inches in one night (Milo Pastoral Company Limited, 1963, p. 19). In 1963, a severe flood saw

losses of 600 to 1000 sheep on each property and Adavale flooded 3 feet above any known flood level, with Ambathala Creek and the Bulloo River at record heights. Yet this was followed by warm weather which brought good feed pasture. However, fires and drought often follow flooding rains, as occurred in 1950 (Milo Pastoral Company Limited, 1963, pp. 21–22). In such conditions, reference to average rainfall is not a reliable measure. It is potentially unrealistic and very misleading, perhaps distracting from what has been described as “the shadow of the biggest single threat to Australian pastoralists – drought” (Milo Pastoral Company Limited, 1963, p. 22). The variable and unpredictable nature of drought remains the most significant issue facing grazing in Australia (e.g. McKeon et al., 2009), leading to seemingly problematic if not inevitable irreversibility (e.g. Ludwig & Tongway, 1995). Other studies suggest a lack of certainty as to past impacts and future beneficial outcomes (e.g. Witt et al., 2006; Witt, 2013). Recent droughts and very recent floods appear to confirm an ongoing irregular cycle. The question is: what to do?



Loading wool at Milo for transport to Brisbane (Photo: Milo Pastoral Company Limited, 1963).

Conclusion

Case studies of history and transition over time can make explicit the extent that negative and positive outcomes are utilised to influence future implementation and changes in accepted practices. It has long been understood, if contested, that the threat to the grazing lands lies in the optimism, the opportunism and the lack of understanding that led the early pioneers of grazing. The story outlined here, and in much more detail elsewhere, of the adventures of my family and others like them, is indicative. They struggled but survived, in each location, until new opportunities created new optimism, a process that arguably continues. But how to better protect both natural and farmed areas remains problematic.

The bigger question, however, is whether these experiences have a message for how to transition to preserve if not conserve the opportunities. Clearly the much-admired grasslands of the past no longer exist in the form they once did. Do innovations such as carbon farming provide a better future for the grasslands? Recent news of overseas interests buying large properties and then using them only as carbon offsets raises a host of new issues, such as pest, fire and weed management. Provision of watering has increased the number and intensity of 'plague' impacts, whether of locusts, mice, dogs and/or kangaroos.

Of course, there have been success stories, many of which form the basis of positive promotion and marketing. But what of the negative impacts? As case studies show, properties such as Boondoon and sections of others are no longer considered viable (if they really ever were), but what should be their future? These properties appear to suffer from excessive optimism and lack of realism in good times. But then comes the difficult but inevitable decision on when to reduce or de-stock, arguably and understandably left too late too often, leading inexorably to loss of vitality, reduction or loss of permeability, loss

of shade and tree cover, and loss of natural and introduced feed.

If drought is such a threat, should areas on the margin of long-term reliability, as previously managed, be considered as suitable for sustainable uses including transition to new uses? Should properties be more closely subdivided, identifying the areas that have potential for more intensive and economically sustainable management for future grazing or farming, while the unproductive land is put to new uses including tourism and conservation? More intensive uses including tourism and conservation have the potential to increase populations living locally, with the added advantage of additional sources of income.

Should new ways of measuring perceived deterioration (e.g. Witt, 2013) but also the potential for new uses determine their future use? At present, it appears the effort to create an image of a sustainable grazing industry is ignoring the lessons of history and transition and is instead turning towards arguments for financial support to continue current and previous practices, albeit with initiatives that are considered beneficial. Clearly, reliance on government funding risks the grazing industry being seen as subsidised, including from a world trade perspective.

If indeed there is inadequate reliable water, and soils are degraded, should such areas be allowed to regenerate without government subsidies in order to provide environmental benefits such as a return to a much more natural tree cover over time with no opportunity to again graze the areas? Is this what carbon offsets or carbon farming offer? Is this the future, and perhaps the price to be paid by those areas for the provision of benefits to more sustainable areas or properties? These questions are clearly in as much need of answers as are those relating to the release of dogs, cats and cane toads. It is past the time for saying: "We didn't know the gun was loaded." We do know what has to be done.

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Author Profile

Michael Yeates is a retired architect with a Master of Environmental Education and a Master of Science in Environmental Management. His interest is inspired by similar aspirations to sustainability in urban areas, tempered by the burden of history and the perceived, often implied threat of change to established and accepted standards.

It Is ‘Carbon Flows’ That Drive Land Restoration

Alan Lauder

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Keywords: Carbon Grazing, carbon trading, carbon stocks and flows



Both sides of the fence are grazing paddocks and neither side is farmed. It demonstrates that poor management of carbon flows over time leads to poor water infiltration.

(Photo: P. Francis)

Introduction

A grazing paddock is a dynamic system, not a static one. To understand how a paddock functions, it is important to understand the role of the element carbon as it flows through different paths after it enters the paddock.

Carbon is a carrier of energy through a natural system.¹ As it moves, carbon takes different forms – such as animals, plant leaves, plant roots and soil organic matter. These different

forms contain carbon in different chemical combinations, and their individual carbon-containing molecules flow through the system at different rates. Carbon keeps flowing above ground as well as below ground, including through commercial livestock.

Energising the Landscape

Carbon compounds in a paddock can be loosely classified into short-term (labile), medium-term

¹ A simplified description of the process by which energy from the sun drives the process of photosynthesis that converts carbon dioxide in the atmosphere to cellulose, other carbohydrates, lignin, etc. These products are utilised by other plants, can provide fuel for animals or are burnt in industrial processes, releasing carbon dioxide back to the atmosphere. In this cycle the carbon dioxide is used as a ‘carrier to trap the energy’ from the sun and convert it into a useful form – ED.

and long-term. Approximately 80% of the new carbon that enters a paddock will return to the atmosphere within 12 months, with the rest entering the medium-term pool. A small amount of this medium-term carbon will progress to the long-term pool. A small amount is also leaving the long-term pool each year, which is why management of carbon flows influences the balance of this pool over time. The dynamic nature of carbon is not revealed by spot measurements taken at a point in time, as standard techniques of measurement capture only 'stocks'. The standard technique uses a 2 mm sieve that removes about a third of grass roots which are labile carbon. Soluble carbon, the fastest-flowing carbon, is outside the measurement process.

Short-term carbon, which accounts for the bulk of carbon flows, moves through the landscape by ongoing interchange between plants, animals, soil and atmosphere. This exchange powers the health of the paddock generally and pastoral productivity in particular. The volume of flowing carbon in a paddock reflects recent land management decisions.

On the other hand, the level of long-term carbon is a consequence of past decision making. Long-term soil carbon is important for paddock health, but its level is slow to change. This is why it is not responsible for short-term changes in paddock health or productivity. Short-term improvements in paddock health and productivity are driven by the short-term carbon introduced in the first phase of carbon flows. It is the flow of carbon through soils, rather than its sequestration in soils, that is the key to healthy soils and sustainable land use systems (Janzen, 2005). Also, the long-term soil carbon has to start the journey as short-term carbon in the first phase of carbon flows.

Carbon Markets Can Deal Only in Stocks

Soil carbon has become prominent in public debate because of climate change policy and carbon trading. Payments to landholders in the form of carbon credit schemes for storing carbon apply

only to long-term forms of carbon, because short-term carbon flows cannot be secured. However, payments in the form of stewardship incentives can be justified for management changes that increase the flow of carbon and so improve paddock and catchment condition. The two purposes are distinct, and different metrics are needed to assess them.

The complexity of any trading regime that attempts to use investment by corporations who have a carbon liability to drive improvements in landscape management is compounded by the differences in motives of those involved. Carbon trades will be administered by brokers with a commercial interest; stewardship incentives distributed by public authorities will have a public interest objective in mind; and landholders' interest will depend on their life stage and financial status. Some of these misalignments have been lucidly highlighted in Blakers' and Considine's critique (2016) of the federal government's Emissions Reduction Fund.

Implications for Management

Central to the concept of sustainability is that pastures should be rested after rain to maximise carbon flows. Perennial grasses must be allowed sufficient time after rain to replenish their carbon-rich tissues, above and below ground, and must be protected from grazing animals (including kangaroos) until growth stabilises. Pasture rest is long enough when sufficient carbon has flowed to all the areas in the landscape that it needs to. In other words, graziers need to be harvesting only the surplus, not the means by which a usable surplus is generated. Pastures should be spelled for 4–6 weeks after rain at least once a year.

An understanding of carbon flows leads into recognition of the importance of timing when managing stock on a pastoral property. The *timing* of spelling (while plants are in the active growth stage) is more important than the length of *time* for which the pastures are spelled. Timing of pasture resting was central to my book *Carbon Grazing – The Missing Link* (Lauder, 2008).

Allowing plants to build carbon in the soil both improves the productivity of the pasture and also advances the process by which soil carbon is converted into durable forms, so improving sequestration potential.

Adoption of the principles of Carbon Grazing will always be financially profitable for the grazier and beneficial for the catchment, but carbon trading brings the risk that land will be taken out of pastoral production altogether.

Conclusion

The dynamic concept of carbon flows highlights the ongoing nature of carbon transfers; whereas the contrasting concept of carbon stocks (measured at one point in time) is a static one and says little about what is driving changes in the health of the landscape.

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Author Profile

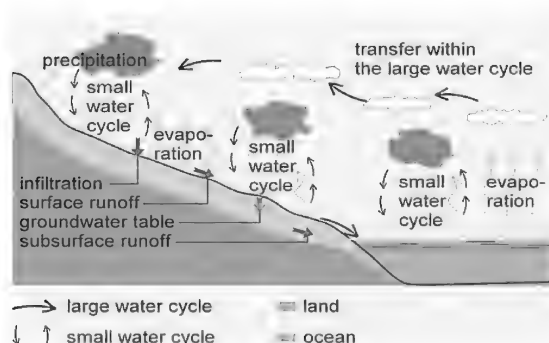
Alan Lauder was a successful rural producer with 30 years' experience of property management in Queensland's south-western pastoral zone. While a wool grower, he produced the world's first guaranteed prickly-free jumper, supplying David Jones and Country Road. Alan was a presenter at the Deakin Lecture series in Melbourne in 2010. His material has been used internationally.

Small Water Cycles: What They Are, Their Importance, Their Restoration

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Keywords: small water cycles



The large and small water cycles (Kravčík, 2015).

Small Water Cycles and the Consequences of Degrading Them

The small water cycle over land is a closed circulation in which water evaporated from land falls in the form of precipitation over the same terrestrial environment. Humanity, through its activities (deforestation, agriculture, urbanisation), accelerates the run-off of rainwater and causes draining of the transformed land. Distortion of the small water cycle impacts the large water cycle (Kravčík et al., 2009).

The small water cycle is more important to local precipitation patterns than the large water cycle. It is estimated that mean global precipitation overland is 720 mm, of which only 310 mm is from the large water cycle and 410 mm comes from the repeated evaporation-precipitation process of the small water cycle (Widows, 2016).

In mismanaged landscapes with little vegetative ground cover, the small water cycles are degraded or destroyed: soil absorbence is destroyed; more heat and carbon dioxide is radiated; and there is little transpiration to nucleate local mists, fogs and rain. In the large water cycle, temperatures increase and rains become both more irregular and often occur as large events – causing increasing damage to a simplified and less resilient landscape (Massy, 2019).

If there is insufficient water in the land, immense flows of solar energy cannot be transformed into the latent heat of water evaporation but are instead changed into sensible heat. Warmer air over hot and dry urban and agricultural expanses pushes precipitation activities into cooler environments formed by woods and bodies of water, or to places of higher latitude or altitude (Kravčík et al., 2009).

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The leaching of fresh water from land into the oceans is one of the most significant factors, not only in global desertification but also in climate change. Human activities, such as deforestation, agriculture and urbanisation, have gradually reduced soil moisture, ground water and vegetation, which in turn have reduced on-land evaporation, completely interrupting the small water cycle (Widows, 2016). The share of global climate change caused by human drainage of water from the land can be stopped or moderated through a comprehensive program of conservation of rainwater on the land, its infiltration and evaporation (Kravčák et al., 2009). See Conclusion 5.

The Need to Restore Small Water Cycles

Half of Australia's annual rainfall is evaporated into the atmosphere, largely because it can't infiltrate a carbon-deficient, compacted soil. We must ensure that more of that water soaks into the soil to the root zone of the plants, not only to help them grow but to be transpired by these plants through their leaves back into the atmosphere, where about two-thirds of it falls again as mostly local rain. A healthy, carbon-rich soil enhances the small water cycle, which in turn retains more water in the cooler soil, generates greater local rainfall, reduces fire intensity and, importantly, helps to create essential cloud cover (Jeffery, 2015). See Conclusion 1.

In urban areas, we need to recycle storm water, domestic waste water and the effluent from sewerage systems. Maximising coverage of our landscape (including our cities) with green will increase the small water cycle, while bare landscapes will reduce it. There are many ways to restore the small water cycle, including slowing the movement of water, repairing the riparian zone (the interface between river and land),

restoring wetlands and flood plains, revegetation, managing grazing, and adopting limited-till and pasture cropping. We need a nationally coordinated water and evaporation management plan (Jeffery, 2015). See Conclusion 2.

Perhaps Not a Wicked Problem, But Instead a Powerful Driver of Beneficial Change

When the Murray Darling Basin plan was formulated, there was almost no discussion about the water cycle and how human activity might be influencing it (Widows, 2016). See Conclusion 3.

Evaporation needs to be viewed not as a loss to the system to be avoided at all costs, but understood and respected as the source of all precipitation and managed accordingly (Widows, 2016). See Conclusion 4.

The true beauty of the small water cycle is four-fold:

1. It provides an observable natural *mechanism* to underpin the micro and macro effects of enlightened farm management practices.
2. It provides an observable natural *mechanism* to more deeply understand and appreciate the true value of woodlands and forests (and the interconnectedness of all things). See photo: Rain over the Desert Uplands.
3. It empowers people – you don't have to improve the world's climate to improve the climate on your property;
4. It provides real hope for the future, if it can be implemented on a large scale – implementation on a large scale could reverse the present rush to extinction.

See Conclusion 5.

Conclusions

1. If we restore a degraded or broken local small water cycle, the temperature and rainfall benefits of that restoration will be *seen* locally and also benefit the wider climate. For instance, cropping and grazing practices need to be redesigned, with the express aim of repairing degraded small water cycles, to the mutual benefit of both farmers/graziers and the natural environment.

2. Queensland needs to create and implement a state-wide coordinated water and evaporation management plan. This plan could later act as a template for a nation-wide coordinated plan.
3. We are fighting over the water that's presently in the rivers, wetlands, lakes and irrigator storage ponds. However, a major water source is that of the transpiration-evaporation-precipitation process – and we can *increase* that.
4. It provides real hope for the future – an ambitious, continuing program of restoration of presently degraded small water cycles may well allow us to avoid irreversible climate destabilisation.
5. Because restoration of local small water cycles can be *demonstrated* to benefit local climates, we can honestly and effectively sell this message, locally, regionally and nationally, thus: “Restore your local small water cycle and you *will* improve your local climate – local summers will be cooler, local winters will be warmer, local droughts will be less severe, local rainfall events will be less extreme. You will see the results in your lifetime. And, oh yes, as a by-product, you will also improve the world's climate.”

Note: All information herein comes from published sources – no research was conducted by the author.



Rain over the Desert Uplands (Photo: Margaret House).

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Author Profile

The author, now retired, worked as a Principal Research Adviser in the Department of Lands (later Department of Natural Resources) in the Queensland Public Service in multiple fields, including applied research and land planning.

Reflections on the Future Use of Pastoral Lands in Australia

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Keywords: degradation of pastoral lands, total grazing pressure, normality of drought, national approach to pastoral land management

Queensland pastoral lands, in spite of the best efforts of pastoralists, are deteriorating (Franks et al., 2002). There are natural resource, climatic, economic, social and management reasons for this.

The long-term viability of pastoral land will be difficult while:

- there is a major divide between the perspectives of rural and urban people on the importance of primary industries to the national economy;
- long-term planning for achieving duty of care for land is expected of rural producers and industries but not of the three levels of government;
- competition rather than cooperation exists between the three levels of government, rural industries and other pastoral land users, be they engaged in pastoral or another land use such as mining, solar farming or an Indigenous land use;
- governments fail to support and encourage rural industries to undertake an appropriate role in meeting both community and private interests; and
- the extension services provided to rural producers are primarily based on the efforts of volunteers involved in Landcare and NRM Catchment Committees.

The reflections offered by Professor Miles to the Dialogue conference are relevant:

- Drought must be considered part of our normal operating environment.
- The productivity of cropping lands and pastoral lands will continue to decline, largely due to inappropriate management by all landholders and governments.
- The need to lower total grazing pressure. This is dependent on the lowering of stock numbers to achieve a better balance for the maintenance of adequate ground and tree cover. However, to achieve enterprise and pastoral industry viability, there may be a need to resume some pastoral leases, to undertake some property amalgamations and to move into alternative use of these lands.

My previous experience within the Queensland Government indicates that there is a mismatch between the economics of pastoral use and how such lands need to be managed, an example being the failure of federal and state governments to support the economic use of eastern grey kangaroos for food and leather. This has been due in part to the mistaken belief by the general community that there is not an overpopulation of kangaroos (which has resulted from their greater access to water and improved pastures) and that kangaroos do not need to be culled, or if culling is necessary, it does not warrant the economic use of the animals culled. Clearly, such action, including the use of the meat and leather, is not

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perceived as meeting a public good. There has been a failure by the kangaroo industry and the market to expand because of concerns raised by environmental groups, especially internationally. For the industry to expand, there is a need for investment in processing facilities.

It is beholden on the three levels of government to provide a lead in seeking a way forward by:

1. Working collaboratively to arrive at long-term solutions, with any costs being shared according to the benefits that arise.
2. Seeking a consensus (hopefully nationally) on the way forward, based on scientific rather than emotional considerations.
3. Ensuring the public is kept informed on what is happening, and needs to happen, in relation to pastoral lands.
4. Removing regulatory impediments that cannot be proven to improve the economic,

social and ecological outcomes (health) of the pastoral lands.

5. Investigating non-regulatory mechanisms for the long-term management of pastoral lands to meet the public needs of those lands.
6. Only using financial assistance when this is the most cost-effective option.

Until it can be established that it is feasible for the private sector to manage the pastoral lands so as to maintain their health while remaining economically and socially viable, without ongoing financial assistance from the public sector, then the existing situation is unlikely to change. Without a major injection of public funds to have these lands remain in pastoral use, they may need to move to a use other than primary industry in order to maintain their overall health. Circumstances are likely to arise where there is a need to move ownership and management away from the private sector and towards the public sector.

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Unfenced watercourses affect water quality and biodiversity on property and far downstream (Photo: G. Edwards).

Author Profile

Now retired, Howard Briggs has had extensive experience in natural resource management at regional planning, impact assessment, research, communication, policy and operational levels with the Queensland and Commonwealth Governments. From August 2001 to March 2013, he was a consultant in policy and planning on the use and management of rural lands.

Tree Clearing and Other Comments

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Keywords: tree clearing, Desert Uplands



A ball put in the middle of a tree pulling chain when dozers were lower powered (Photo: C. Nason).

Introduction

The following are notes from an on-ground landholder who has owned and worked on a property in the Desert Uplands Bioregion in central western Queensland for 36 years. These are some comments after hearing the rangelands talks.

Our Experience with ‘Tree Clearing’

1. Knocking down trees disturbs the soil and hence has a beneficial effect by releasing nitrogen, etc., from the soil, the same effect as digging up the soil before propagating plants in a garden in town.
2. This disturbance leads to much more grass and vegetation germination. Grass cover has a very beneficial effect on soil health and soil carbon and reduces soil erosion. Ground cover, in particular deep-rooted grasses and forbs, maximises soil carbon; tree cover does not.
3. Trees lying on the ground have a beneficial effect over time on the plants and soil. They provide protection for plants to grow up around them; they help to prevent soil loss/erosion from run-off after a heavy fall of rain; and they help to reduce topsoil loss by catching air-borne dust and falling leaves. Topsoil and leaves

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provide mulch around the fallen logs, which is beneficial to the growing of vegetation.

4. When trees are knocked down in the old growth forest country in the Desert Uplands Bioregion, the roots in the ground are still alive, as they are very deep. After the next decent fall of rain, every tree regrows. Some trees such as gidyea can be a lot slower to grow, while others such as ironbark take off very quickly.
5. During the long drought that we have been experiencing, we have noticed that in some of the old-growth forest country on our property, up to 70% of the trees have died – and even more in places. However, of the trees that we had previously pulled down, every single one has regrown and not one of these young, regrowing trees has died during this drought. Surely this has a very beneficial carbon-sequestering effect ...?
6. Unbiased research needs to be done over 15 years plus (in order to experience severe drought as well as a big wet) into carbon sequestration in pulled country and neighbouring old-growth forest country. Landholders could be paid to allow their regrowth trees to grow for 20 or more years, before being re-knocked down, in order to obtain maximum carbon benefits for the environment.

Environmental Protection/Improvement

One speaker mentioned that economics has the most significant impact on the environment in the rangelands. The Social Research Project in the Desert Uplands Bioregion, carried out by the Desert Uplands Committee and led by Gerry Roberts, found that younger landholders who had greater financial debt and young families to educate, etc., were more likely to be focused on the economics of their enterprise. It was the over-70s with much less debt (their families had grown up and were no longer dependent on them financially) who were interested in the environmental health of their properties and were taking the most action to improve it. Younger people were

definitely interested in environmental health; however, they were much less financially able to take on-ground action.

Hence, yes, the payment of landholders/enterprises to improve and care for the environmental/ecological aspect of their land should be a necessity. We are caring for the land for the benefit of all Australians of the present and into the future. Should not all Australians contribute towards the cost of doing this?

Such payment could be the equivalent of the agistment that would have been received on the numbers of livestock that have been reduced in order to have less impact on the vegetation. Or, in a farming situation, the payment could be the equivalent of the net profit that would have resulted from cropping that portion of land that has been set aside and no longer farmed.

The government and all Australians need to recognise the eco-services produced by landholders, especially as it is a cost to the landholder to run fewer livestock or farm less country. Landholders shouldn't have to bear the cost of the expectations of and benefits to the rest of Australia.

Healthy Food Production

Livestock that graze on the natural pastures of the rangelands, that free-range and often walk several kilometres a day, provide much healthier meat and milk than animals that are kept in yards for months in very close proximity to one another, unable to exercise, and fed a lot of non-natural food products. This healthy outcome should definitely be recognised, promoted and rewarded.

One of the questions asked of the speakers was why some landholders didn't notice the damage being done and do something about it.

Again, the Desert Uplands Social Research Project found that personality types play a very important part in how people operate their businesses and how they see their environment. One needs to appeal to different personality types in the way that they best understand and operate, in order to communicate with them more successfully.

As with all industries, with the carrying out of new ideas in the pastoral industry there are always the few who grab an idea first and experiment with it. The rest watch to see what the outcomes are. If the idea is successful, the majority will then gradually follow. There will always be a small number who refuse to change, unless there is a real and decent benefit, or legislation forces them to take action.

The majority of primary producers are not good at communication with government officials, public servants, university researchers, etc. They learn mostly through talking to their neighbours and other primary producers in a similar business. Again, through our Desert Uplands Social Research Project, we discovered that some landholders cannot read or write. This

does not mean that they are not successful in their business. They tend to be very successful as they have other advantages such as much greater observational powers.

Legislation, or forcing landholders to not use some of their country because of the presence of endangered species, etc., can often have a detrimental effect on the eco-outcomes. In order to obtain the best eco-outcome, the landholder should be rewarded for taking care of his/her property.

That way, instead of destroying or hiding their assets, as has happened in the past, people will come forward and acknowledge what they have. This will be of benefit to the whole country. Reward, not threats or punishment, has the best outcomes.

Author Profile

Margaret House has spent the last 36 years on a property in the Desert Uplands Bioregion outside Aramac. She and her family have always been interested in environmental issues and joined the Aramac Landcare group when it was first formed.

Out of the Landcare group they formed the Desert Uplands Build-Up and Development Committee in 1994–1995, as so many families in the ‘desert’ were struggling to survive. Most of the men, including Margaret’s husband, worked off-farm to keep their properties financially viable, while the women and children ran the properties during the week. Yet the people were tough, multi-skilled, and very resilient.

The Committee organised carbon workshops in the region in 1998 and followed that with carbon research into the region’s trees and soils. A Social Research Project was launched to understand people’s attitudes and actions towards their enterprises and their environment. Over time, it was noticed that the natural environment on the properties of those landowners who were struggling financially, or who went broke, ended up in a very poor state.

The Committee won a Landcare award for its Landscape Linkages Project, which paid landholders to improve on-ground/environmental outcomes; however, Margaret believes passionately that more research and extension of research outcomes are needed.



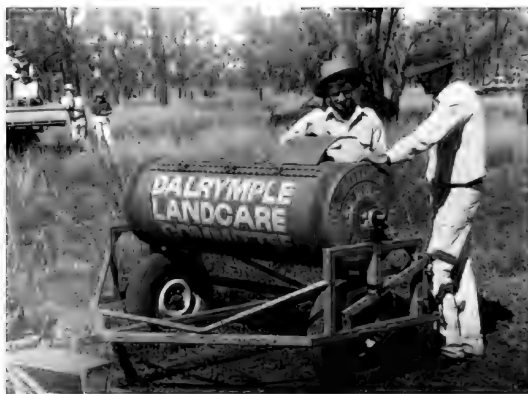
Desert fringe myrtle (*Calytrix microcarpa*) mostly occurs in the Desert Uplands Bioregion.
(Photo: Margaret House)

Re-visioning Landcare to Deliver Ecosystem Services West of the Divide

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Keywords: ecosystem services, landcare, fencing clusters



This paper races ahead of discussions on acceptability and feasibility of paying landholders for delivery of ecosystem services: it goes straight to implementation, suggesting that Landcare groups and fencing clusters can play key roles in facilitating landholder adoption, measurement and payment for services in the rangelands of Queensland.

Landcare Background

During the 1980s, land management groups were forming in Queensland in parallel with community participation initiatives in Western Australia and Victoria. Arguably, the first 'grassroots' community action in this period was the formation of the Lockyer Watershed Management Committee as a Bicentennial project in 1981, with several sub-groups tackling local issues. Then, in 1984, the

Inglewood Shire Bicentennial Land Management Committee formed to develop land management guidelines for the Shire (subsequently becoming the Inglewood and Texas Landcare Committee), and in 1987–1988 conservation committees formed at Charleville (South West Rural Conservation Committee) and Goondiwindi (Waggamba Conservation Committee).

The Department of Primary Industries (DPI) fostered several soil conservation groups in the 1950s and 1960s. However, these fell away when the government introduced a mandatory program for erosion control in the Darling Downs and Burnett regions in the early 1970s. Six advisory committees were formed to advise on priorities and implementation. When the mandatory approach was abandoned in the mid-'80s, DPI resumed the encouragement of community

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responsibility for land management action. In 1987–1988, nine ‘landcare’ type committees formed from the advisory committees. In this same timeframe, further impetus came from the Cattlemen’s Union. A proposal put to the Gympie Beef Liaison Group in February 1988 by Jock Douglas was a huge game-changer, legitimising Landcare amongst Queensland’s grazing communities (government efforts had to that time focused on cropping lands). At least three groups formed in 1988 through this initiative – Gympie, Dalrymple (Charters Towers) and Maranoa (Roma) – and doubtless others. As well as catalysing these groups, the Cattlemen’s Union established Land Care sub-committees in each district. It also pushed for a national Landcare program.

Other Landcare groups operating when Queensland Landcare was launched in March 1989 included: Arcadia Valley, Calliope, Capricorn Coast, Central Burnett, Chinchilla, Murilla, North Burnett and Taroom. With appointment of a State Landcare Coordinator and Regional Landcare Facilitators, plus the impetus of the National Landcare Program (announced July 1989), the number of groups soon increased dramatically from the initial 25. However, the Queensland Government soon moved towards an Integrated Catchment Management approach, believing that major issues needed whole-of-catchment action rather than a patchwork of Landcare projects. Four pilot Catchment Coordinating Committees were formed in 1991, followed by others. Some Landcare groups felt as though they had been supplanted by the catchment groups. Then, in 2000, the Australian Government, seeking a more accountable structure (catchment committees were non-statutory and varied greatly in capacity), added another layer, the regional natural resource management groups. This pushed Landcare groups further down the ladder for funding and priority attention.

A three-tiered structure heralded serious implications for the resilience of Landcare groups. After peak enthusiasm in the 1990s, some Landcare

groups have struggled to maintain motivation, partly due to difficulty in obtaining funds for projects and hire of coordinators. Some have closed and some struggle to survive. A 2017 survey of the original 25 groups showed that six had ceased and four were in hibernation or serious decline (Keith, 2017). On the upside, 60% have continued to function for 30 years, showing laudable resilience in the face of adverse policy headwinds.

Funding and support for Landcare groups depended heavily on the extent to which the regional bodies recognised Landcare groups as partners, but often the only funds available were via competitive bidding for projects to achieve regional goals, which in most instances were dictated by federal government priorities. The principle of Landcare groups acting according to their local priorities was vanishing. Professor Peter Bridgewater, Chair of the National Landcare Network, succinctly summarised the decline in momentum when introducing a 2019 review of Landcare:

The early phases of Landcare were characterised by great momentum and a high level of participation but it also demonstrated that local groups with limited resources were unlikely to produce landscape level change. Subsequent phases were intended to better deliver nationally coordinated programs, but to the extent that significant control and power was transferred to regional bodies or central and state government, many community Landcare groups suffered disempowerment and decline. An important finding from the review is that these approaches all have their strengths but need to be concurrent (Bridgewater, 2019).

The problem was exacerbated by government moves towards a purchaser–provider approach in the Caring for Country program from 2008, where the government purchased NRM goods from the regional bodies, focusing on environmental outcomes that could be quantified in purchaser–provider agreements, without regard for outcomes such as learning, improving skills

and building trust. The community-based model was further eroded when proposals were invited from a wider range of organisations than in the past and embraced a wider range of policy instruments, including market-based incentives (Curtis et al., 2014; Robins & Kanowski, 2011). This competitive purchaser–provider approach has been continued by the current government, with billions of dollars allocated to environmental management programs such as the Emissions Reduction Fund, Agriculture Biodiversity Stewardship Program and drought mitigation initiatives without being built into the community NRM framework, thus missing the opportunities for more effective delivery through networks of community groups.

This paper proposes ways to benefit from community-based delivery of rewards to landholders for ecosystem services, while giving new purpose to flagging groups and re-invigorating valuable latent social capital.

Which Groups and Which Ecosystem Services?

The Queensland Water and Land Carers (QWaLC) website shows approximately 45 member groups with primarily land management objectives west of the Great Dividing Range. Five are catchment management committees across the regions, 15 Landcare groups are in the primarily cropping area of the Condamine Catchment, and there are about 25 other Landcare groups from the New South Wales border to the Gulf. Also included in the QWaLC list are 30 recently formed fencing cluster groups. Fencing clusters are small groups of contiguous landholders who gain government grants to cover about 50% of the cost of dog-proof fencing material. The number is likely to increase with a recently announced round of grants. Although fencing to protect stock has generally improved land condition, not all are motivated by a landcare ethic in their management practices (a notable exception is Clovelly Hills Cluster, which was a finalist in the Innovation in Agriculture and Land Management category of the 2018 Australian Landcare Awards). But evidence

of improved condition might be a step towards interest in providing ecosystem services. How can the social capital built into cluster groups become a force for the delivery of ecosystem services?

The Millennium Ecosystem Assessment report of 2005 defines ‘ecosystem services’ as benefits people obtain from ecosystems. It distinguishes four categories of ecosystem services: *supporting services* such as nutrient recycling, soil formation, habitat provision and pollination; *provisioning services* such as food, raw materials, medical resources and energy; *regulating services* such as carbon sequestration, control of predators, pests and diseases, and purification of water and air; and *cultural services* such as spiritual and historical heritage, recreation, science, education and therapy.

Let us assume that it is agreed that public funds should reward landholders who manage properties in ways that provide a national good while also providing food and/or fibre. Decisions about which *services* governments, corporations and philanthropists might reward are matters for discussion and negotiation. Development of appropriate tools for monitoring and auditing, for research into sustainable management models and to identify services landholders are able to provide will require specific consideration. However, much information on specific elements already exists.

If a reward for sustainable management practices is available, we can reasonably assume that landholders will need technical support in adopting suitable practices.

Landcare Facilitation of Ecosystem Services Delivery

Landcare groups and fencing clusters can be foci for efficient technical advice and for efficient auditing (properties within a group or cluster audited simultaneously when the group is ready for audit). Technical advisers for selected services could be employed by regional NRM groups. Auditing would be contracted out to accredited providers.



Field day on 'Trafalgar', Dalrymple Landcare Group (Photo: R. Shepherd).

As clusters are small and regions are big, clusters could be linked to form larger aggregations within a common agro-ecosystem for management of ecosystem services, with incorporated bodies, perhaps called District Landcare Committees, deciding which ecosystem services should receive technical assistance within the district, coordinating its provision, and perhaps having a role in distributing payments. These committees would have a paid Landcare Coordinator who would advise the committee, foster practice adoption by smaller Landcare groups and clusters, and encourage formation of new groups.

This concept of two-tiered Landcare is not new. While Queensland adopted Victoria's name 'Landcare' for community groups dealing with local land management issues, the structure varied from the Victorian model. Early Queensland groups were larger, generally Shire-based and addressed more diverse issues. This changed

over time with smaller groups forming, the larger groups often acting as project fund managers for smaller groups. It is noted that the committees envisioned by the Cattlemen's Union at Gympie in 1988 had expected roles quite similar to those espoused here for District Landcare Committees: awareness raising, recommending suitable land management practices, administering incentives, and advising on research and development needs and extension resources (Douglas, 1988).

Membership of a District Committee could vary from place to place and might include representation of landholdings in the district plus the coordinator, a representative of the relevant regional NRM body and an independent Chair. In districts where clusters don't apply, the committee would operate with current Landcare groups and encourage formation of new groups to take advantage of opportunities for technical advice and efficient auditing. Some current

groups might have the capacity to take the role of District Committee. Where viable catchment management groups exist, these could carry out the functions of the District Landcare Committee. While the focus here is on rangelands, the concept is easily transferable from west of the Divide to all of Queensland. Participation would be voluntary and not preclude other agendas.

Conclusion

This proposal looks ahead of the present discussion on the desirability and feasibility of rewarding landholders for managing ecosystem services and identifies the opportunity to re-invigorate Landcare structures west of the Divide.

Landcare in Queensland gained high momentum in the 1990s, but government policies to control and redirect funding later impeded groups' efforts to achieve their local goals, so momentum faltered. This can be re-invigorated if ecosystem service program implementers recognise the efficiencies of collective action through community-based natural resource management groups and provide the support resources needed, and if groups see a benefit in linked action to provide sustainable services. Although social benefits are not included in the purchaser–provider equation, social capital will accrue as a bonus with delivery through networks of Landcare groups and fencing clusters.

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Author Profile

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We Need to Start with Where People Are At, Not Where We Want Them to Be



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For around 30 years, different governments, industry groups and academic entities have worked to extend their knowledge and practice to landholders across the rangelands, with the view that this will result in their improvement in condition, trend and extent. These efforts have employed often ingenious approaches built on great logic and the understanding that preaching and teaching and showing sustainable practice will ultimately result in improved landscape outcomes. The evidence shows that this approach has not worked well, given that the limited monitoring and evaluation of the condition and trend of our natural assets demonstrate a continuing and, in places, accelerated decline across most landscapes (Department of Environment and Science, 2018).

Conventional wisdom says we should try harder, make more rules and policy, and be more creative and develop more targeted, better prioritised programs and approaches with more comprehensive modelling and monitoring so we can garner more money from governments. My experience teaches me that this approach has and will continue to fail us, and for one basic reason: we do not understand well enough the people we are wanting to influence.

Little research exists to help us understand who manages our landscapes; instead, the majority of assumptions are based on more workshops, more education, more data and more science to help these people do better. The limited research

done in the early 2000s by the University of Queensland around Central Queensland and Strachan on agriculture industry personality profiles indicates that up to 80% of our land managers have a personality and learning profile which indicates that the majority of our attempts at extension do not reach them or their learning networks (Shrapnel & Davie, 2001; Strachan, 2011). Trying harder to make these approaches better means little to these people.

Conclusion

As a result, we need to form a way forward based on:

1. Learning more about the people who look after our rangeland landscapes.
2. Discovering ways to help their learning and to practise improvement on the terms which make sense in their day-to-day lives (likely to be around business risk and working trials).
3. Finding ways to help them measure their improvement in ways that make sense to them, with the result that natural capital is improved at their pace.

This approach puts the people who impact rangeland landscapes at the centre of their own learning and improvement. While academia and practitioners can put labels on the resulting initiatives and discuss ecosystem services and

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other components for better landscape outcomes, the language and practice of improvement needs to focus back on what is meaningful to the person/entity actually causing the impacts. The 20% that do learn through extension approaches already know whatever is being offered. Some

have told me that they have learned nothing from us (the NRM groups) over the past 10 years.

Any policy or dialogue we have on our range-lands is unlikely to result in any real change on the ground unless we change our approaches to extension first.

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Author Profile

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Sculpture in the desert (Photo: Margaret House).

Conclusion

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Extensive tracts of the rangelands of Queensland and Australia are in crisis. Whether it is revealed by indicators of biophysical condition and trend, or measures of socio-economic strain, these lands and their communities are in widespread decline. This trend raises serious questions in terms of long-term sustainability and food security. Unfortunately, no overall metric is available to quantify the extent of this decline across the whole state, but the collective view of the contributors to this Dialogue and these *Proceedings* is that it is widespread and serious. Some parts of the rangelands such as the Channel Country are in relatively good condition. Parts of this region and elsewhere are managed by large companies with multiple properties across regions. This means they can conduct a form of pastoral nomadism at a large agribusiness scale to better manage pasture resources.

These rangelands are unique and in their symbolism may be likened to other great natural assets of Australia such as the Great Barrier Reef. Sustainable management of these lands, occupying about 80% of Australia's landmass, is an imperative, given their pastoral productivity, their biodiversity and their iconic cultural heritage that plays no small part in defining Australia's identity.

Whilst many of the dry lands around the world are also seriously degraded and their communities impoverished, Australia has the economic and knowledge capacity to reverse this trend on our continent. The degradation trend has been brought to scholarly and public

attention many times before, e.g. at The Royal Society of Queensland's special conferences on the Brigalow Belt of Australia (1984) and the Mulga Lands (1986). Further, a comprehensive review by the Australian Government and all rangeland State and Territory governments led to the development of the *National Principles and Guidelines for Rangeland Management* in 1999, following 30 public workshops across Australia. This cooperative, multi-government forum attempted to develop a new vision for the rangelands but failed to gain traction. Previous calls by experienced Arid Land Administrators and many drought and economic forums have all expressed a common concern about the use and management of the rangelands.

The Rangelands Dialogue heard that the current economic settings cannot lead to ecological sustainability of the rangelands and, especially, cannot remedy the legacy of degradation over more than a century. Drought policies and assistance packages generally focus on immediate relief, whereas long-term adjustment measures are required.

The impoverishment of land and people is now accentuated by rapidly materialising changes in climate. A general warming with increased variability is now beyond rational doubt; and in most places across Queensland's rangelands, the climate is drier and hotter.

No longer is a model of *business as usual* deemed appropriate or responsible.

External funding for carbon sequestration creates a key opportunity to drive significant

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change in land management, and much stronger price signals are not unrealistic given the extent of measures that will be required to meet the threat imposed by climate change. This response could be further enhanced with financial institutions requiring regenerative agriculture as insurance against bad returns from unsustainable use and management.

Policy change might involve change in land use, in tenure, in the economic framework that currently does not reward supply of ecosystem services or restoration of natural capital, and in apportioning responsibility for observing duty of care between public and private agents.

To illustrate the breadth of measures that might be required to achieve ecological sustainability, rangelands could be classified into a number of categories each requiring a specific set of measures, for example:

- Submarginal lands deemed uneconomic for continuous pastoral use and beyond the capacity of private ownership to address land restoration.
- Marginal lands where rural reconstruction, incentives for managing ecosystem services and building resilience are still realistic.
- Better-watered localities where ecologically sustainable management should be incentivised.

Significant policy initiative is required. The organisers of the Rangelands Policy Dialogue are optimistic that this civil society-led initiative might be what is required to kick-start policy change.

It has been advocated in papers in this collection that there is a need for the formation of a new public authority. This could take the form of a Rangelands Authority or similar statutory entity at a national or state level. Such an authority could promote policy review at multiple scales, foster broad community support for the rangelands, secure long-term funding for research and extension, possibly manage the rehabilitation of degraded areas that are unviable for pastoral production but may have multiple values, and incentivise the production of ecosystem services.

Subsequent to this Rangelands Dialogue, a Rangelands Declaration was endorsed in August 2019 by the three co-sponsors: the state's senior scientific institution, The Royal Society of Queensland; the peak body for the regional catchment bodies, Natural Resource Management Regions Queensland; and the pastoral industry's peak body, AgForce. The Rangelands Declaration, appended below, provides a platform for cooperative development of a new vision for Queensland's rangelands and new institutional arrangements to implement the vision.

Declaration for the future of our Rangelands

Brisbane Dialogue, 2019: a conversation on Queensland's rural future and implications across the Australian outback.

In the face of...

- A deep and enduring attachment to Queensland's outback country, its rural communities, and the iconic ecosystems on which they depend;
- Ongoing decline in these communities due to unrelenting economic pressures, a legacy of unfortunate planning and legislation, and the lack of bold, forward-looking policy choices;
- The compounding effects of a highly variable climate that is expected to become hotter and increasingly variable, with more severe episodes of flood and drought, and persistent ecosystem stress; and
- The resulting vulnerability of production systems to frequent disruption, a widespread decline in land condition, and the tragic loss of biodiversity throughout the ecosystems that sustain us; then

We, as Queenslanders, need to...

- Accept there are pressing issues in our Rangelands and an urgency to bring urban and rural communities into serious and constructive conversation;
- Celebrate our common agreement on the biological, cultural, and economic necessity of a flourishing, populous, and life-affirming outback, while minimising attachment to outdated ideologies that only serve to separate people from one another;
- Affirm that landscape management properly rests in the hands of people acting with modern knowledge and Indigenous wisdom, and that they are the trusted custodians of sustainable utilisation, conservation, and regeneration;
- Recognise that more investment is required to build the ecological health of our country, including arrangements that deliver stewardship and natural capital payments; therefore,

We, the undersigned, commit to...

- Cultivating an enduring and respectful rapport between land managers and the public, enabling fulfilment of mutual rights and obligations;
- Supporting a Rangelands reform agenda that includes:
 - ◆ Reviewing and revitalising institutional arrangements to deliver strengthened regional participation in land use planning, regulation, and conflict resolution;
 - ◆ Programs to enable the informed and ethical use of data to ensure all people can participate in shaping the Rangelands future in a constructive manner, particularly in the area of natural capital accounting;
 - ◆ Cooperative ownership of a biennial State of the Rangelands Report presenting social, biophysical, cultural, and economic indicators of condition and trend;
- Establishing a Rangelands Consultative Council, independent of government, but inclusive of it, to improve our institutional capacity for developing and delivering improved governance arrangements and practical management solutions across the Rangelands, for the benefit of the country, its rural communities, and for Australia's current and future generations.

20 August, 2019



This special edition of the *Proceedings of The Royal Society of Queensland* presents a compelling case for change in the management of the rangelands to achieve a sustainable and vibrant future.

No longer is a 'business as usual' model going to prevent further deterioration in the natural and human capital, let alone repair the damage to natural capital wrought over past eras. Together with biophysical degradation is the social strain on individuals and the decline of rural communities and regional support structures.

It will require the broader Australian public to listen to those who live in the rangelands and the scientists who are monitoring significant change, to forge a new direction for the vast and iconic outback.